

# The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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## Fertiliser Manufacture

ALTHOUGH the density of our population is great, and the majority of our people earn their living in the towns and great industrial centres of population, the march of events and the eloquence of Mr. Lloyd George combine from time to time to make us realise that agriculture is perhaps our greatest single industry and that the prosperity of agricultural Britain is a vital necessity in times of peace and of war. The superphosphate industry, in common with the ammonia industry, thus becomes of transcendent importance not only as a contribution to our present war effort but also to our peace-time economics. The important paper published on pp. 139-142 of this issue, on "Possible Development of the Superphosphate Industry," by the Swedish authorities, Sven Nordengren and Hans Lehrecke, will serve to disclose what in the authors' opinion are the weaknesses of superphosphate and the possible new competitors with which the standard process of its manufacture may be faced. This paper illustrates aptly an important point raised during the discussion of the recent paper on "The Chemical Plant Manufacturer in Relation to Chemical Industry" at a meeting of the Chemical Engineering Group of the Society of Chemical Industry. It provides in its way an answer to those who would insist that the plant manufacturer should always keep one jump ahead of the plant user. The process to be used in superphosphate manufacture, as in many other chemicals, depends upon the local conditions, the price of sulphuric acid, of fuel or of other materials mentioned as being used in possible competitive processes, and also upon the quality of the product in relation to the soil on which it is used, as disclosed by agricultural research and experience. A plant manufacturer could thus only keep ahead of the superphosphate industry by maintaining a research organisation able to conduct research for the whole industry on every conceivable process.

The possibility of the replacement of standard processes by new processes capable of producing the same product more cheaply or of providing a better product must be a constant occasion for watchfulness on the part of every chemical manufacturer. Messrs. Nordengren and Lehrecke show that in practice there may be no such thing as a "better product"; one product is not perhaps intrinsically better than another one—it is more suited to a particular soil. The suitability of the product for the purpose for which it is to be used must be the care of the manufacturer, for he alone knows the conditions of usage. The plant manufacturer certainly does not. It is a century since the manufacture of superphosphate was started in this

country and the authors can see no other material likely to compete with it in the near future. Nevertheless thermal processes appear to them to present possibilities and they advise the industry to follow the development of these methods with the keenest attention. We do not yet know what the ratio of the cost of fuel to other production costs in these processes is, but in view of a statement that in one process the rock is heated to 1400° C. it would appear that the cost of fuel may be considerable. The rising cost of coal in this country makes it less likely for the thermal process to be introduced here than in other lands with more favourable fuel costs; and that might conceivably lead to a serious disadvantage in the export market.

Perhaps the most interesting section of the paper is that dealing with the water-solubility of superphosphate. In the standard textbook on the subject published last year ("Calcium Superphosphate and Compound Fertilisers," by Parrish and Ogilvie) it was remarked that certain private reports "reveal that there is interaction of calcium superphosphate with certain constituents of the soil, and doubt certainly exists as to the wisdom of the application of water-soluble P<sub>2</sub>O<sub>5</sub> to certain of these soils."

The authors of this paper boldly affirm that the long-accepted assertion of the merits of water-soluble phosphoric acid is without foundation, and suggest by implication that the subject has never been properly examined. They declare that water-soluble phosphates spread on the surface of the soil penetrate only 1 to 1½ inches because they are converted into insoluble compounds by the soil constituents, and although at first rendered citrate-soluble, later become citrate-insoluble. They indicate that one method of avoiding this fixation, which destroys the value of superphosphate as a fertiliser in certain soils, is the practice of producing a granulated product, but they believe that manufacturers do not yet realise the full value of granulation. Only compound fertilisers are made in Europe in the granulated form, and in the light of the facts disclosed in this paper the superphosphate industry might well investigate the water-solubility value of their product and also consider the production of it in granular form. Another method advocated for achieving the same object is that the water solubility of the product should be changed into citrate-solubility. There are products on the market in which this has been done, and if these prove superior in fertilisation value to the usual product, it seems evident that some changes in technique are likely to come in the phosphate fertiliser industry.

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## NOTES AND COMMENTS

### The New War Loan

THE first national War Loan cannot fail to be a triumphant success. The Government asks for what on the present scale of budgeting is the strictly limited sum of £300,000,000, and twice or thrice as much could assuredly be raised for the great purpose to which it is applied. Still it is the fact that the patriotic appeal is not the only favourable feature of the new War Loan. With a redemption period of from only fifteen to nineteen years, the investor's capital is guaranteed, and the three per cent. rate of interest is as nearly as possible the exact return available for this class of gilt edged stock. Banks, insurance companies and other financial interests can be depended upon to do their bit, and it is up to business and industrial firms not to fall behind in this effort. If firms have any cash by way of reserves or other savings lying idle they can have no hesitation in earmarking it at once for the three per cent. War Loan.

### Petroleum Refining in France

ACCORDING to a semi-official report, which has just been published, the French petroleum refineries are working to capacity. The petroleum policy pursued in France before the war aimed at diminishing the importation of finished products and the increase in the importation of raw petroleum, principally from Iraq. To transform this raw petroleum, several important refineries, equipped with modern plant, were established; the Government advised them to improve the quality of their production, at the same time insisting on the manufacture of aeroplane petrol. The French policy in petroleum, and in the supply of raw materials, is based primarily on the French share (23.75 per cent.) in the Iraq Petroleum Company, which ensures Iraq petroleum for France. While in 1929 France imported 1.67 million tons of petrol and only 23,900 tons of raw petroleum, the establishment of a national refining industry has succeeded in upsetting this proportion. In 1938, 6.9 million tons of raw petroleum were imported, with 1.2 million tons of finished products.

These figures, which are in excess of the actual needs of France, indicate that, in 1938, the French Government began building up a stock of petroleum. In 1938, 45 per cent. of the importation of raw petroleum came from Iraq. Since the outbreak of hostilities, though actual statistics are not available for publication, the tendencies already mentioned above have become more pronounced. The importation of raw petroleum has been increased, as far as possible, at the expense of the importation of petrol; the importation of the latter being now of relatively small importance. Seeing that transport by the Mediterranean route is unimpeded, the transformation of the French refineries in peace-time has proved to be an extremely wise step. The carriage of Iraq petroleum demands no great effort on the part of the allied war fleets to safeguard it and the petroleum supply has not been affected.

### Canada's Chemical Trade

FOR the year ending December, 1939, Canada's imports of chemicals and allied products were valued at \$43,705,905, of which \$7,374,727 came from the United Kingdom and \$30,668,134 from the United States. For the month of December the corresponding figures were: total imports \$4,232,509; from the U.K. \$658,581; from the U.S.A. \$3,032,720. Exports for the year of chemical and allied products amounted to \$24,263,342, of which \$5,730,789 was the value of goods sent to the U.K., and \$9,683,576 to the U.S.A. The December export figures recorded a total of \$2,194,239, of which the U.K. took \$302,099 and the U.S.A. \$910,631. Imports of all commodities for December from the U.K. were valued at \$8,458,573, as against \$7,032,923 for December, 1938, but the total for the year stood at \$114 millions in contrast with \$119 millions for 1938. It is worth recording that the figures for December, 1939, showed an excess of exports, in the trade with the U.S.A., amounting to \$54 million.

### Boiling Point of Selenium

IN the long gap between the boiling point of sulphur (444.60° C.) and the freezing point of gold (1063° C.) there is no fixed point which can conveniently be used for the routine calibration of thermocouples in terms of the International Temperature Scale. The boiling point of selenium (about 690° C.) is suggested as a possible fixed point in this region, and as a first step towards enabling it to be used for this purpose the precise determination of its value has been undertaken. This determination was the subject of a paper on "The Boiling Point of Selenium," presented by Mr. M. de Sélincourt and read in title at a meeting of the Physical Society on March 8 at Birkbeck College, London, E.C.4. The determination was carried out in a silica boiling tube similar to that normally used at the sulphur point, having a re-entrant tube fitted with a radiation shield. By connecting the apparatus to a reservoir, the variation of the boiling point with pressure over the range 700 to 800 mm. of mercury was also determined. The measurements were made by means of three standard platinum *vs.* platinum-rhodium thermocouples calibrated at the freezing points of gold, silver and antimony. Samples of selenium from two sources, and two types of radiation shield, were employed and gave the same result. The value found for the boiling point in terms of the International Temperature Scale was 684.8 ± 0.1° C. at normal atmospheric pressure, with a variation of 1.08° C. per cm. of mercury.

## POSSIBLE DEVELOPMENT OF THE SUPERPHOSPHATE INDUSTRY

By

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**L**AST year and this will constitute landmarks in the history of the superphosphate industry, for a century has passed since Liebig suggested the treatment of bone-meal with sulphuric acid in the production of a phosphatic fertiliser, and since superphosphate was manufactured for the first time on a technical scale in England by Lawes. During the last hundred years superphosphate has maintained its position as the principal phosphatic fertiliser, and it has resisted all attempts to displace it from this position of honour. It is little short of remarkable that the manufacture of calcium superphosphate continues to be undertaken in almost precisely the same manner as obtained a hundred years ago, although the mechanical devices have been improved.

The reason for this is not far to seek. Simplicity of operation, and the essential cheapness of the process, are the dominant considerations which have rendered the method of manufacture impregnable. To grind the raw materials—bones, coprolites, phosphorites and apatites—to subject such ground material to the action of sulphuric acid, allowing the mixture to solidify, and to disintegrate the resulting product, are unit processes of such simplicity as to admit easily of reproduction on a large scale.

The acid used in the decomposing process is the cheapest known mineral acid, and the raw phosphatic materials are available in large quantities in various parts of the world. By a curious coincidence, the concentration of sulphuric acid produced by the lead chamber process—the process which has maintained its importance and prestige for a longer period than any other—is found to be almost identical with that demanded for the manufacture of calcium superphosphate. Moreover, the primary raw materials—phosphorite and apatite—have revealed such a uniformity of chemical characteristics and physical attributes that constancy of technique has followed as a natural corollary.

On the occasion of the centenary of the superphosphate industry, the question might well be asked: is this established technique to continue in the future, without modifications, and is it in the interests of superphosphate manufacturers to continue to produce the same quality of material, or has our increasing knowledge suggested any changes of technique and application? Before these questions are answered, it will be well to study the present situation, and review our experience without prejudice. In this way only can a correct perspective be arrived at—one that is calculated to guide us aright in determining the steps to be taken to strengthen and fortify the future position of the superphosphate industry.

### Competitors of Superphosphate

It is desirable, first of all, to make a careful study of phosphatic fertilisers, both present and future. The oldest competing phosphatic fertiliser, guano, has lost its earlier significance, on account of diminishing deposits and restrictions in the export of these deposits from the countries in which they arise. Meantime, basic slag has achieved importance as a phosphatic fertiliser. Its advantage over superphosphate lies in the fact that it is a by-product, and the cost of production depends on the extent to which steel is produced. This factor enables producers of basic slag to sell their product at a lower price than that of superphosphate.

Hitherto, basic slag has constituted the principal competitor of superphosphate. In several countries, however, other

phosphatic fertilisers are marketed which, like basic slag, have a citric-acid-soluble, or even citrate-soluble, content of phosphoric acid. Among these may be mentioned the German "Rhenania-Phosphate," which is manufactured by sintering phosphate rock with soda and silica. Other products belonging to this group, as sold in France and Belgium, known as "Basi—" and "Supra-Phosphate," with citrate-soluble phosphoric acid, and the Russian "Thermo-Phosphate," are probably made in a similar manner. All these thermal processes are based in principle on the process of Professor Wiborgh, of Stockholm, which was developed and practised about forty years ago.<sup>1</sup> Finally, mention should be made of the dicalcium phosphate produced mainly in Russia, France and Belgium, in combination with processes involving, as a by-product, hydrochloric acid.

### Ammonium Phosphates

Apart from such fertilisers, in which the phosphoric acid is soluble in citric acid only, or in ammonium citrate solution, there is another group of fertilisers, having a water-soluble phosphoric acid content, but combined with other fertilising compounds. Such fertilisers are mono- and diammonium phosphate and compound fertilisers containing these phosphates, such as the "Nitrophoska" of the I.G. Farbenindustrie, the corresponding products of Imperial Chemical Industries, Ltd., the "Ammophos" of the American Cyanamid Co., and others.

Coming now to the significance of these fertilisers, and their competitive possibilities, it can be said that basic slag has already reached a position where further competition can be expected only in relation to the increase in steel production. The importance of the other fertilisers produced thermally, with the help of alkali, containing their phosphoric acid in citrate-soluble form, will depend upon the price of the soda. The process is simple, and may well compete with superphosphate in this respect. The present soda ash prices make it rather improbable that the competition of such products will increase in the near future. If a process were evolved by which the production of soda could be made cheaper, the soda-containing phosphatic fertilisers would probably acquire some significance, as a result of which soda could be expected to take the present position of sulphuric acid in the phosphatic fertiliser industry. No signs of such reduction of soda prices have yet been observed.

The ammonium phosphates mentioned above might also become more important if it were possible to reduce the cost of producing phosphoric acid. On the other hand, the use of such fertilisers will be limited, as many countries will prefer to employ each fertiliser separately, and to regulate the proportions of the different fertilisers according to soil requirements.

In recent years considerable work has been undertaken, at various centres, to find a process of treating phosphate rock in a thermal way, without the addition of soda or other alkaline compounds. Up to now the methods used have not culminated in production on a commercial scale. It is conceivable, however, that the technical and economical problems involved will be solved, in which event superphosphate will be faced with a serious competitor. It therefore behoves the superphosphate industry to follow the development of these methods with the keenest attention.

The basis of the more important of these processes is the transformation of the phosphate rock or apatite, in the presence of silicic acid and water-vapour at high temperatures, to hydroxyl-apatite, and then to  $\alpha$ -tricalcium-phosphate, a compound soluble in citric acid and citrate solution. This

\* This paper was to have been read at the meeting of the International Superphosphate Manufacturers' Association at Hamburg on Sept. 13-15, 1939, but the outbreak of war led to the cancellation of the meeting.

process was investigated on a laboratory scale about the same time by two German firms<sup>2</sup> and the Bureau of Chemistry and Soils, Washington.<sup>3</sup> Subsequently, details have been published of another process, by which the phosphate rock is decomposed by heating at sintering temperature with lime and silicic acid in given proportion to the phosphoric acid.<sup>4</sup> The effect of water-vapour is not mentioned in this publication, but there is no doubt that its presence is necessary, to break down the molecule of the fluorapatite.

The reason why these methods have not succeeded on a technical scale may perhaps depend on the velocity of the defluorisation, which even if large quantities of water-vapour are present, is too low at the temperatures of sintering that have been used. Moreover, it may be difficult to obtain the necessary free surface when working on a larger scale, as contrasted with the laboratory. It would appear, therefore, that processes employing temperatures in excess of smelting-point, and involving less water-vapour, offer better prospects of success, even if the difficulty of furnace-lining may be greater.

In the United States a new type of phosphatic fertiliser—calcium metaphosphate<sup>5</sup>—has been produced. Phosphoric acid anhydride, produced thermally, reacts on phosphate rock, forming the said compound. How far this product can be manufactured practically and economically on a large scale it is impossible to say at present. No one has so far succeeded, under normal economic conditions, in producing phosphoric acid for fertilisers so cheaply, by a thermal process, that it can compete with the wet process. It is true that phosphoric acid is being produced by heat treatment for fertilising purposes, but then the acid is used to fix ammonia, and it seems that the ammonia also covers part of the cost of production of this phosphoric acid. The fertilising value of calcium metaphosphate, as contrasted with superphosphate, has yet to be determined, although it has proved satisfactory in the trials already conducted.<sup>6</sup>

### **The Quality of Superphosphate**

Before any comparison with other phosphatic fertilisers is made, the quality of superphosphate should be studied from physical, chemical and agricultural points of view. As mentioned already, the nature of superphosphate and its agricultural effect have remained practically unaltered during the last hundred years. Certainly, the quality has been improved. The relationship between the quantities of phosphate rock and sulphuric acid, and the strength and temperature of the latter, have been regulated in such a way that a product of better physical properties, with a small amount of free phosphoric acid, can be manufactured. The moisture content of the product has been reduced from 15–16 per cent. to as low as about 4 per cent., by the employment of strong sulphuric acid, and the adoption of means of drying. If comparatively strong sulphuric acid is used, a product with 8 to 10 per cent. of moisture can be manufactured without the necessity for drying. Pulverisers have been installed, with a view to producing a material of fine consistency, and the larger granules are removed by sieving.

Despite all these improvements, it must be admitted that a further improvement of the product is desirable. Although it is pulverised and sieved, the difference in particle size is considerable, and its plasticity and thixotropic property render distribution by spreading machines difficult. When superphosphate is stored in bulk, solidification, or “caking,” cannot be avoided, and when the material is stored in bags these are destroyed after a time, because even a seasoned product contains a certain amount of free phosphoric acid. Bagging is therefore usually undertaken at the time of sale, which results in an accumulation of work at that time. If a phosphate rock with a comparatively high degree of iron and alumina is treated, the water-solubility will decrease after a certain period of storage, as indeed, under certain conditions, will the citrate-solubility. These disadvantages of superphosphate cannot be ignored.

It has, moreover, been asserted that one of the merits of

superphosphate is the water-solubility of the phosphoric acid, and this attribute was said to give superphosphate an advantage over other phosphatic fertilisers. That a critical examination of this view should be made becomes increasingly important.

It has long been accepted that the water-soluble phosphoric acid of calcium superphosphate reacts on the soil with great rapidity. Heavy and acid soils react in this respect more rapidly than light and alkaline soils. It has been found that if superphosphate is spread on the surface of the soil, without being forked in, the phosphoric acid will penetrate only 1–1½ inches into the soil.<sup>7</sup> The cause of this fixation is the formation of water-insoluble compounds between the free phosphoric acid or the monocalcium phosphate and basic matter in the soil, such as iron, alumina, lime, etc. Further hydrolysis of the monocalcium phosphate to insoluble products occurs. The result is that the water soluble compounds of the superphosphate have little or no direct fertilising effect. This, of itself, would not constitute a disadvantage, if the phosphoric acid in these compounds were easily assimilated by the plant roots, because in such circumstances the superphosphate would possess the advantage, as contrasted with other water-insoluble phosphatic fertilisers, that its phosphoric acid would be more evenly distributed in the soil.

Unfortunately, in practice the foregoing is not realised. The new products formed with iron and alumina are at first citrate-soluble, but after a time, and especially after periods of drought, they lose their citrate-solubility, and consequently their fertilising value is reduced. This loss of solubility occasionally takes place so rapidly that a soil known, by analysis, to require phosphoric acid, has revealed no increase of yield when fertilised with a normal quantity of superphosphate. The fixation and transformation into insoluble compounds is more intensive in acid soils, because iron and alumina are present in a more reactive form than in alkaline soils. Even in neutral or alkaline soils, having little, if indeed, any iron, the fixation of the water-soluble phosphoric acid occurs fairly rapidly, although slower than in acid soils. This probably depends on hydrolysis, and on the formation of dicalcium phosphate and hydroxylapatite, which latter compound is insoluble to plants.

That the phosphoric acid content of superphosphate is constantly fixed in all soils, is shown by the fact that the quantity of phosphoric acid absorbed by plants during the first year seldom exceeds 40 to 50 per cent. of the total quantity used, and may even be as low as 15 to 25 per cent.<sup>8</sup> In acid soils it is often lower than the latter figure. Obviously, a modern fertiliser should be more efficient than this.

### **Effectiveness Improved by Granulation**

That the superphosphate industry must consider methods by which to reduce, or otherwise avoid, the fixation referred to, clearly connoting insolubility of the phosphoric acid, is manifest. Equally, an effort must be made to increase the fertilising effect of the superphosphate. Two methods of approaching this problem are available to the manufacturer. The first is to render the physical properties of the superphosphate such that the fixation of the water-soluble phosphoric acid is reduced, or obviated. The other is to modify the chemical composition of the product, so that the reactions by which the insoluble compounds are formed cannot occur.

The first of these methods has already been exploited in a practical manner by the granulation of the product, although the results of such granulation are not yet fully realised.<sup>9</sup> The United States have taken the lead in this development. The American Oberphos process, where decomposition is effected in an autoclave, produces a superphosphate in a more or less granular form.<sup>10</sup> Superphosphate produced in dens in the usual way may also be granulated. The manufacture of granulated superphosphate from the ordinary product was begun some years ago by The Davison Chemical Corporation, Baltimore.<sup>11</sup> Their product is being sold in increasing quantities. In Europe only compound fertilisers have been sold in granulated form, but during the last year the question of

granulation has been investigated by several workers, as indeed by the authors.

The interest which granulated superphosphate has evoked up to now is mainly attributable to the essential advantages arising from its storage, transport and use. The granulated product is less susceptible to "caking," when stored, than ordinary superphosphate. It can be loaded into bags of different types, such as, for example, paper valve bags. The bags are subjected to considerably less attack by the granulated product than by pulverised superphosphate, and consequently the bags can be stored over a longer period. Moreover, losses due to dust are avoided.

An advantage to the farmers arises from the fact that the granulated product will not "film" the distributing machinery, which not infrequently happens with ordinary superphosphate. Another merit, which hitherto has not been adequately appreciated, is that granulated superphosphate can be introduced into the soil at exactly the right depth<sup>12</sup>—a feature of the greatest importance in the problem of effective fertilisation. This effect may be still further increased if the superphosphate is distributed in drills between the rows of seeds. The yields thus obtained are considerably greater than if the superphosphate were uniformly distributed in the soil.<sup>13</sup> If granulated superphosphate is placed in rows at the right depth the increase of yield is surprising. Field tests made by O. Franck with granulated superphosphate, placed in rows at the right depth the increase of yield is surprising. Field tests made by O. Franck with granulated superphosphate, placed in rows at a distance of 11 cm. on both sides of the seeds and at a depth of 8 to 10 cm. in certain Swedish soils having a high degree of fixation for phosphoric acid, have given an increased yield of oats of 500 kilos per hectare, compared with trials in which the same amount of finely-ground superphosphate was introduced to the soil in the ordinary way.<sup>14</sup> It is reasonable to assume that this means of improving the fertilising effect will result in an increased demand for granulated superphosphate.

This improvement in the fertilising effect of granulated superphosphate over ordinary superphosphate is due to a lesser fixation of water-soluble phosphoric acid. Thus, more of the latter is available for use by the plant or root crops. The improvement in question is the more marked, the more uniform the distribution, a condition that can be attained when granulated superphosphate is applied in drills. This increased fertilising effect, which is particularly evident on acid soils containing iron and alumina, has recently (in 1937) been ascertained by the investigations made by O. Franck, at the Central Institute for Agricultural Research at Stockholm.<sup>15</sup> His results have been confirmed by tests undertaken by G. Torstensson, of the Academy of Agriculture at Ultuna, Sweden,<sup>16</sup> which were published about the same time, and by other later field tests.

#### Mechanism of the Granules' Action

Franck explains the sensible increase of yield when using granulated superphosphate—an increase, under field tests, of up to 100 per cent. and more of the yield which was obtained with the same amount of ordinary superphosphate—in the following way. Around every granule of superphosphate is formed a spherical zone where the water-soluble phosphoric acid reacts with compounds of the soil which fix the phosphoric acid. In the zone in question, these compounds are saturated with phosphoric acid, which enables the rest of the water-soluble phosphoric acid to move freely in this space. When a root approaches this spherical zone, it will find such a high concentration of soluble phosphoric acid that it will develop a system of thin roots around the granules, and the plant can thus easily obtain its requirement of phosphoric acid. This root system has been clearly demonstrated by photographs. Franck further found that these thin roots extend to within a distance of 2 to 3 mm. of the phosphate granules, where, it is suspected, the most suitable concentration of phosphoric acid is to be found. The phosphoric acid content of fine-ground superphosphate is more rapidly fixed

in the soil, and no reserves of water-soluble phosphoric acid are left.

The second method of obviating insolubility and metamorphosis of the phosphoric acid of superphosphate within the soil, as already remarked, is to modify its chemical composition. What is possible here is to change the water-solubility partly or wholly to citrate solubility. Citrate-soluble phosphoric acid will not revert to insoluble phosphates so rapidly, or even to the same extent, as the water-soluble, because the citrate-soluble compounds have only a small power of motion in the soil, and do not react with its iron and alumina compounds as readily as the water-soluble compounds. It is known that fertilisers containing phosphoric acid in a citrate-soluble form give good fertilising effect, which explains why, in several European countries, as well as in the United States, superphosphate is being sold not on the basis of water-soluble phosphoric acid, but on water- and citrate-soluble "available" phosphoric acid. These products are, however, largely water-soluble.

#### Citrate-Soluble Phosphoric Acid

There are several phosphatic fertilisers already on the market containing phosphoric acid only in a citrate-soluble form. Among these may be mentioned dicalcium phosphate, Rhenania-phosphate, ammoniated superphosphate, as well as others, manufactured by processes of sintering or smelting. Mention should also be made of the Kotka-phosphate produced in Finland by the decomposition of phosphate rock with considerably less sulphuric acid than is normally used. As this product, apart from the mono- and dicalcium phosphate, contains a large proportion of undecomposed phosphate rock, it can only be used to advantage on such acid, humic soils as are found in Finland.

The question might be asked: Is it possible to produce a phosphatic fertiliser with its phosphoric acid in a citrate-soluble form as cheaply and simply as superphosphate is being produced? Theoretically, it would be possible to produce a dicalcium phosphate from phosphate rock with about half the quantity of sulphuric acid required for the production of ordinary superphosphate; but as far as is known, no one has yet succeeded in producing a dicalcium phosphate from phosphate rock and sulphuric acid in one process. Decomposition with about half the usual quantity of sulphuric acid results, we find, in a mixture of monocalcium phosphate and undecomposed phosphate rock, and only very small quantities of dicalcium phosphate. If the superphosphate manufacturer wishes to make a dicalcium-phosphate-containing fertiliser, he is compelled, in the first place, to make ordinary superphosphate, and then, by suitable additions, to change its water-solubility partly or wholly to citrate-soluble phosphoric acid.

We have conducted experiments with a view to manufacturing such products by mixing superphosphate, under favourable conditions, with basic slag. The citric-acid-soluble compounds and the lime in the basic slag react with the water-soluble compounds in the superphosphate, and form the citrate-soluble phosphoric acid compound, dicalcium phosphate. Tests undertaken by the Experimental Station of the International Superphosphate Manufacturers' Association at Hamburg-Horn, and by the Central Institute for Agricultural Research at Stockholm, have already shown, during the first season, that such a product, in comparatively small granules, will give fertilising results wholly comparable with those arising from granular superphosphate. It is probable that these products will retain their fertilising effect longer than the granular superphosphate. Trials have been arranged to confirm what is suspected.

Instead of basic slag, it would be possible to use other material having a basic effect, such as lime; carbonate of magnesia, etc., but if such compounds are added the content of phosphoric acid of the final product will be reduced. It would be preferable to employ substances containing phosphoric acid in a citric-acid-soluble form. In this way it would be possible to increase the phosphoric acid content of the final

product. Suitable substances for this purpose would be fused or sintered phosphates. These products appear to possess all the qualities required for the manufacture of "reversed super," and this is another reason why the superphosphate manufacturer should maintain an interest in the development of this group of fertilisers.

We have also found that another product well suited for this purpose can be produced if ordinary superphosphate is heated to a temperature of about  $1400^{\circ}\text{C}$ . At this temperature the sulphuric acid radical of the calcium sulphate is separated, and citrate-soluble  $\alpha$ -tricalcium phosphate and tetracalcium phosphate are formed.

### Reduction of Free Phosphoric Acid

Recently the authors have endeavoured to combine the advantages of the physical method of improving the quality of superphosphate with the chemical one. Ordinary superphosphate manufactured in "dens," or in a continuously-operating process, is granulated, and the granules, when ready, are mixed with a powdered product, containing citric-acid-soluble phosphoric acid. This product can be either basic slag or a product arising in a smelting or sintering process. A reaction takes place instantly between the monocalcium phosphate and the free phosphoric acid of the granules and the citric-acid-soluble compounds of the powder. A crust is formed on the surface of the granules with a higher percentage of citrate-soluble phosphoric acid than in the interior, where it remains water-soluble. The product possesses excellent physical properties, being dry, hard and non-corrosive. The free acid not only disappears from the surface, but is also considerably reduced in the interior by diffusion into the crust, where reaction of the free acid increases the  $\text{P}_2\text{O}_5$  content of the crust.

This process affords a solution of a problem which has engaged the attention of manufacturers of superphosphate from the earliest times. It is the problem of how to reduce the free phosphoric acid in the product without essentially diminishing its water solubility. The neutral reaction on the surface of the granules gives the product better storage and drilling qualities. As to its fertilising value it is still too early to make a definite statement, but there is every reason to believe that it will be highly effective, and that the action on the soil will be even better than when ordinary granulated superphosphate is applied. The crust of water-insoluble products will protect the reserve of water-soluble phosphoric acid in the interior of the granules from a too rapid extraction with accompanying fixation of the extracted products until the roots of the plants have grown sufficiently. Moreover, the crust contains silicic acid in a colloidal form, assimilable by the plants. This condition is known to aid the fertilising effect of phosphoric acid.

Obviously, a product manufactured on the foregoing lines would be more expensive than ordinary superphosphate. If the granulation is effected in conjunction with a continuous superphosphate process, the costs are moderate. Moreover, the costs involved in connection with the products to be added are comparatively low. On the other hand, the increased economy due to the additional fertilising effect of the phosphoric acid in superphosphate is tangible. It should be remembered that the greater part of the soils under cultivation in many European countries are deficient in phosphoric acid, and that their phosphoric acid requirements cannot be met by ordinary superphosphate, by reason of the fixation of phosphoric acid in the soil. Consequently, the employment of ordinary superphosphate does not pay. If the quality of superphosphate and the method of applying it to the soil are improved, the fertilising effect will, no doubt, be increased, and it will be an advantage to use phosphatic fertilisers on many soils where hitherto their employment had been uneconomic.

As there is a deficiency in phosphoric acid in the majority of agricultural soils, even if normal quantities of phosphatic fertilisers are applied, improvement of their fertilising value

will result in a better utilisation of all the other constituents of vegetation in the soil, according to Liebig's "law of deficiency")<sup>17</sup>, and Mitscherlich's "law of the efficiency of the components of vegetation.")<sup>18</sup> Hence any increase of the fertilising value of superphosphate would be of paramount importance to agriculture throughout the world.

It is hoped that this contribution affords an indication of the probable direction in which the superphosphate industry will develop during the next few years. That there should be more intimate co-operation and collaboration between manufacturers and agricultural chemists, experimental stations and farmers, is evident, and we wish to give renewed emphasis to this view. The ideas of the customer should be sought, and an endeavour made to meet his requirements, however vaguely or indefinitely these may be expressed. Only in this way can a favourable development of the superphosphate industry be expected. The manufacture of superphosphate was first conceived by the greatest agricultural chemist of his time, Justus von Liebig, and it is felt that the superphosphate manufacturer, having concentrated his interest during the last hundred years mainly on the economic, mechanical and chemical aspects of the process of manufacture, should now devote some attention to the insistent task of agricultural research.

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## INSTITUTE OF CHEMISTRY

### Sir R. Pickard's Report at Annual Meeting Dr. J. J. Fox Elected President

**I**N submitting the annual report of the Council of the Institute of Chemistry at the sixty-second annual meeting held at 30 Russell Square, London, W.C.1, last week, Sir Robert Pickard, senior vice-president, referred to the death of the president, Mr. W. A. S. Calder, which occurred early in January. Sir Robert spoke of Mr. Calder's services to the Institute and to the professions of chemistry and chemical engineering, as well as to his exceptional ability and other personal qualities which had endeared him so firmly to all who knew and worked with him. He referred also to the deaths of Mr. F. G. Edmed, late Admiralty chemist, member of Council; Professor Henry Louis, a notable metallurgist and mineralogist; Sir William Pope, the brilliant research worker; Sir Gilbert Morgan, who possessed as wide a knowledge of chemistry as any man of our time; Mr. Edmund Nevill, chemist and astronomer, a Founder Fellow and member of the first Council of the Institute; Dr. Frank Shutt, an eminent Canadian agricultural chemist; and Mr. George Stubbs, formerly Deputy Government chemist.

The Institute, stated Sir Robert, as the professional organisation of chemists, had been called upon to assist the Government in supplying its needs in technical personnel for industries essential in war time, and largely owing to the support of the Fellows and Associates, the requirements of State and of industry had so far been supplied. The roll of the Institute continued to increase and now numbered more than 7,550, more than five times as many members as were registered in 1914. Those who could remember the position forty years ago, and recall the difficulty at that time of making any headway in the profession of chemistry, had watched the astonishing increase in the number of chemists, their growing influence, the increasing applications of science and the steady absorption of chemical talent in industry and commerce, in Government and municipal service, and in the affairs of everyday life. The profession of chemistry now stood high in the public esteem as a very essential service.

The hon. treasurer of the Institute had given a satisfactory report on its finances, which, he felt confident, would continue secure. He wished that he could say the same of other chemical organisations which had to meet the ever-increasing burden of publications. He appealed to the Fellows and

**Dr. J. J. Fox, C.B., O.B.E.,  
the new President of the  
Institute of Chemistry.**



Associates to support the publishing societies and he hoped that, with the help of a fund which had been raised by the Chemical Council, from industry as well as from chemists themselves, the affairs of the publishing Societies—the Chemical Society and the Society of Chemical Industry—would be placed on a sounder financial basis.

Dr. J. J. Fox, C.B., O.B.E., government chemist, was elected president in place of the late Mr. Calder, and other officers and members of Council were elected as follows:

**Vice-Presidents:** Professor H. V. A. Briscoe, Dr. F. H. Carr, Professor T. P. Hilditch, Sir Robert H. Pickard, and Dr. H. A. Tempney.

**Hon. Treasurer:** Mr. J. C. White.

**Members of Council:** Mr. W. M. Ames, Mr. E. B. Anderson, Mr. A. L. Bacharach, Mr. M. Bogod, Mr. R. R. Butler, Dr. A. Coulthard, Dr. W. M. Cumming, Dr. J. C. Drummond, Mr. F. P. Dunn, Dr. A. E. Dunstan, Mr. L. Eynon, Dr. E. H. Farmer, Professor A. Findlay, Mr. W. Godden, Dr. P. F. Gordon, Dr. E. Gregory, Dr. A. A. Hall, Mr. J. W. Hawley, Professor I. M. Heilbron, Dr. H. H. Hodgson, Mr. T. R. Hodgson, Dr. W. Honneman, Dr. R. H. Hopkins, Dr. H. Hunter, Mr. G. King, Dr. L. H. Lampitt, Mr. J. H. Lester, Dr. P. Lewis-Dale, Dr. G. W. Monier-Williams, Dr. A. C. Monkhouse, Mr. H. W. Moss, Mr. J. R. Nicholls, Dr. T. J. Nolan, Mr. D. W. Parkes, Dr. W. S. Patterson, Mr. A. J. Prince, Mr. T. F. E. Rhead, Mr. W. H. Roberts, Dr. F. M. Rowe, Mr. S. B. Watkins, and Dr. J. Weir. A district member of Council for the Overseas Dominions and Elsewhere Abroad will be elected at the first meeting of the new Council.

## Resistance to Incendiary Bombs

### New British Standard

**W**ITH a view to minimising the dangers resulting from possible incendiary bomb attacks, active consideration has been given by the A.R.P. Department of the Ministry of Home Security to the development of materials which could be used in the attics and roof spaces of buildings so as to confine and afford protection against the incendiary effect of the bomb.

In order to assist in the development of such materials a test has been devised by means of which the performance of materials under incendiary bomb effect may be ascertained. This method of test, together with the results which should be expected from a suitable material, has been made the subject of a standard in the BS/ARP series, which has just been issued by the British Standards Institution as BS/ARP 27.

It is stated in a note to the Standard that the method of test is one which has been in use for some time at the testing station of the Fire Offices' Committee, and it is indicated that the tests on materials will be made at the Elstree Testing Station on behalf of manufacturers who would like to have their materials examined.

## Alleged Wrongful Dismissal

### Chemical Firm to Pay Damages

**W.**ATLEY, a former employee of Athole G. Allen (Stockton), Ltd., Chemical Works, Bowesfield Lane, Stockton, was awarded £3,000 damages with costs against the firm at Leeds Assizes last week in an action in which he claimed for alleged wrongful dismissal.

Announcing that the action had been settled by consent of both parties, Mr. J. Willoughby Jardine, K.C., for Atley, said the original claim was for £4,300. His client had recently obtained employment, although not at the remuneration he would desire, and he had been met in a spirit of compromise by his late employers.

Mr. C. Paley Scott, K.C., for the firm, said his clients were now engaged on very important work for the Government. The trial of the action might have taken three days—some people thought six days—and would have involved attendance in Leeds of important people connected with the firm.

Mr. Justice Croom-Johnson gave judgment for Atley for £3,000 and ordered payment out of court of £1,000 in part satisfaction. His lordship said he would enter judgment with liberty to apply.

## Personal Notes

DR. H. W. MELVILLE, the newly appointed Professor of Chemistry at Aberdeen University, is to co-operate with PROFESSOR FINDLAY, his predecessor, in the planning and equipment of a new Chemistry Department.

\* \* \*

Among the delegates who have come to London for the Anglo-French trade talks with the F.B.I. this week, the following are well known in the chemical and allied industries: M. RENE DUCHEMIN, president of the Etablissements Kuhlmann; M. MARLIO, president of the Compagnie des Mines et Produits Chimiques d'Alais, Froges, et la Camargue; and M. PAINVIN, president of the Union des Industries Chimiques.

\* \* \*

DR. LEWIS FRY RICHARDSON, F.R.S., principal of the Paisley Technical College and School of Art for over ten years, is resigning on May 15 in order to carry out important research work. The governors of the College have agreed to appoint MR. JOHN DENHOLM as acting principal on the retirement of Dr. Richardson. Mr. Denholm joined the College staff in 1905 and is now head of the department of physics and college registrar.

### OBITUARY

MR. JOHN Y. ROGERS, head of John S. Rogers and Sons, Ltd., Rosemill Chemical Works, Strathmartine, Dundee, died recently aged 77.

\* \* \*

MR. JOHN TALMAN, a well-known figure in the iron trade in the West of Scotland, died last week, aged 82. He served with the Dalmellington Iron Company, Ayrshire, for 61 years, retiring from the post of general manager of the company's stores in 1931.

\* \* \*

MR. DUNCAN ELLIOTT ALVES, founder of an Imperial scheme for securing and building up oil reserves for the British Navy and for national purposes, died last week, aged 70. He assisted in the foundation of a Chair of Oil Technology at Birmingham University.

\* \* \*

MR. WILLIAM COPELAND SWEET, a director of Messrs. W. and R. Hatrick, Ltd., manufacturing chemists, 158 Renfield Street, Glasgow, and a well-known figure in Scottish chemical trade circles, died recently in Glasgow, aged 52. Mr. Sweet had been associated with Messrs. Hatrick for 40 years, and joined the firm when he left school.

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MR. MORRIS CHARLES LAMB, technical chemist, Guildford, has left estate valued at £32,975 (net personalty £16,530).

\* \* \*

MR. DAVID PERRY, J.P., of Glasgow, chemical manufacturer, has left personal estate in Great Britain and abroad of £73,532.

### CHROMITE ORE IN INDIA

The existence of a considerable quantity of chromite ore in a part of the Bombay Presidency readily accessible by sea is reported by the Geological Survey of India. Owing to its low grade the ore will not be readily marketable so long as high grade ores are available, but there are industrial possibilities for the ore in the manufacture of potassium bichromate; similar low grade ores are used in the bichromate industry in Russia. The major occurrence is near Kankauli in the Ratnagiri district and a smaller deposit is found near Vagda in the Savantvadi State; the existence of chromite deposits in these localities has long been known, but the available information about them was meagre. Samples of the ore collected have been analysed and the chromite content was found to vary between 31 and 39.37 per cent; the Vagda ores were found to be richer than the Kankauli ores.

## New Control Orders

### Aluminium Control

THE Ministry of Supply has made arrangements with the British Aluminium Company and the Aluminium Company of Canada for substantial increases in the output of aluminium in the United Kingdom and Canada. In Canada, for instance, the increase in output is sufficient to make the total capacity of that country alone almost equal to that of Germany. The two companies have, moreover, undertaken to co-operate with the Ministry of Supply in developing any further increases in capacity which may be required. The Ministry has also purchased the entire output of the British Aluminium Company for 1940 and of the Aluminium Company of Canada for the remainder of 1940 and the whole of 1941, less only that required for consumption in Canada and for fulfilling certain pre-war commitments. Basic prices approximately equal to those current in the United Kingdom and Canada before the war have been agreed.

### Iron and Steel Scrap Prices

New prices for iron and steel scrap are fixed in the Iron and Steel (No. 7) (Scrap) Order, 1940, which came into force on March 5 and supersedes the Control of Iron and Steel (No. 5) (Scrap) Order, 1939 (S.R. and O., 1939, No. 1626). The effect of the Order is to increase the main range of maximum prices of iron and steel scrap by 5s. to 10s. a ton, and adjustments to meet changing conditions have led to larger increases in a few cases. Certain additions have also been made to the specifications of the material covered by the maximum price provisions.

## Copper and Manganese Determination

### Sodium Diethyldithiocarbamate as Indicator

A N improved method for the determination of small amounts of copper and manganese in dyes, intermediates and rubber chemicals is described by Palfrey, Hobert, Benning and Dobratz, of the Jackson Laboratory of E.I. Du Pont de Nemours and Co., Inc. (Ind. Eng. Chem., Anal. Ed., 1940, 12, 2, 94-96).

Sensitive analytical methods for determining the presence of these elements have long been in demand, and the procedure has been modified on several occasions in the last decade. The method now recommended is to destroy the organic matter by wet oxidation with sulphuric and nitric acids, followed, when necessary, by hydrogen peroxide. Copper is then determined colorimetrically by using sodium diethyldithiocarbamate as indicator, as this material has proved more sensitive than potassium ferrocyanide, the indicator previously in general use. Manganese is determined, as previously, by oxidation to permanganate, using potassium periodate as indicator.

The procedures have been checked on samples of azo, sulphur, basic, and vat colours, intermediates, rubber chemicals, and rubber, both as produced and after the addition of known amounts of copper and manganese. Both these elements can be determined in the presence of iron, lead, zinc, barium, aluminium, and small amounts of cadmium, and in the presence of each other. The methods may be applied to other materials such as fabrics, pigments, and inorganic chemicals, provided other metals are not present in interfering amounts, and show high accuracy. In some cases as little as 0.0002 per cent. (0.01 mg.) of copper and 0.0001 per cent. (0.005 mg.) of manganese may be detected on 5-gram samples. The amount of copper in the solution to be compared should not exceed 0.1 m.g. per 100 cc.

Wet digestion with mixed acids was found the most suitable and accurate method of destroying organic matter because of the solubilising action of the acids. It is a longer process than ashing in porcelain, but the latter often results in contamination with siliceous matter, while the use of platinum crucibles led to the formation of insoluble residues.

## Ethylene Oxide and Cotton

### Various Interesting Effects Obtainable

INTERESTING modifications in the properties of cotton as a result of the action of ethylene oxide are described by Lawrie, Reynolds, and Ward (*J. Soc. Dyers and Colourists*, 1940, 56, 1, 6-17).

The cotton is first either impregnated completely or else printed with caustic soda, which must be of higher strength than 10 per cent. and is usually 15 or 22-23 per cent., according to the effect desired. The excess caustic is expressed between rollers, but it is preferable not to dry the material, which is now treated with ethylene oxide in carbon tetrachloride solution, the reaction being fastest in this solvent, out of all the possible common solvents, and the solution being also non-inflammable. The reaction may be carried out at room temperature, but is enormously hastened by raising the temperature to 50° C., which can be done with safety. The reaction may also be carried out in brine solution, but the effects then obtained are somewhat different, since the brine permits a rather deeper reaction, probably because the dissociation of sodium ions from the cloth is repressed by the common ion effect.

Application of the oxide in the gaseous state gives effects very similar to those attained in solvents, but the difficulty of devising suitable apparatus for the study has so far prevented a detailed investigation being made. After treatment, the solvent is removed by hydro-extraction, the material soured with dilute sulphuric acid, and then washed acid-free with water. Drying follows, and here interesting effects can be introduced by calendering the cloth, whilst its plastic nature after reaction with the oxide enables it to be dried without shrinkage if kept under tension.

The chief effects of the treatment are the enhancement of stiffness and transparency. The strength is only slightly affected, and the affinity for vat and direct cotton dyes is increased, though difficulties in levelling may be met with. The effects obtained may be described as: (1) organdie, (2) linened, (3) parchmentised, these being all-over effects, (4) window-pane, (5) printed damask, (6) figured velvetine, and (7) lace, these four being attained by printing. (1), (3), (4), (6), and (7) are obtained by using caustic soda of mercerising strength (22 per cent.), and high proportions of ethylene oxide; (5) which is more or less printed linened, is arrived at by using high strength soda, and low or high quantities of oxide, according to the effect desired; and (2) by the use of low strength soda and small quantities of oxide. Parchmentising is the result of calendering thin cloths in the drying process after treatment, and material suitable for tracing cloth may thus be made.

No useful result was obtained by treating rayon, jute, or linen with the oxide, and higher alkyl oxides did not give results of sufficient interest to warrant an extended investigation.

### GLYCERINE FROM BONE GREASE

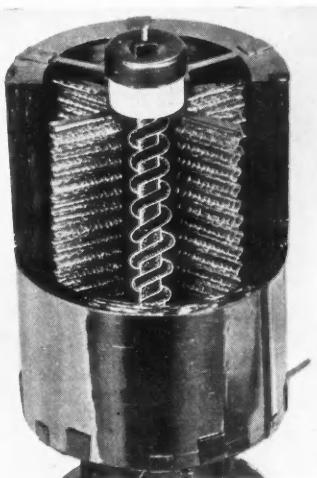
The problem of profitable extraction of glycerine from bone grease has been intensively attacked in recent years in Italy and the Montecatini group of glue manufacturers is now operating plants at Saranno and Turin in which the cost of separation is more than repaid by the value of the recovered glycerine in spite of the small percentage of the latter (5 per cent.). Considerable interest has also been aroused by a new process for splitting bone grease into fatty acids and glycerine, developed in the Montecatini laboratories by Curletti and Martini, which dispenses with the necessity for autoclave treatment. Instead of discontinuous treatment in the latter, the grease is run continuously through a narrow copper coil after emulsification with water and incorporation with a catalyst. The products emerging from the coil are a mixture of fatty acids and glycerine water.—*L'Industrie Chimique*, Dec. 1939, 695.

## The Dispenser Cathode\*

### High Electron Emission

MODERN oxide cathodes have an electron emission which decreases gradually with time of operation, owing to mechanical failure or evaporation of the active coating. Dr. A. W. Hull, of the research laboratory of the General Electric Company, Schenectady, has recently announced a dispenser cathode, in which the coating material is slowly released by a "dispenser" during the operation of the tube.

This material, depositing on the cathode members, constantly renews the emitting surface. Thus an exceptionally high electron emission is maintained during the entire life of the tube. The illustration shows the structure of a cathode of this type. The dispenser, shown as a helix in the centre of the cathode, is a closely woven mesh or "stocking" of fine molybdenum wires, filled with granules of fused BaO-Al<sub>2</sub>O<sub>3</sub> eutectic. The electron-emitting members, initially uncoated, are radial vanes of clean molybdenum located within the common heat shield. In operation the helix serves as a heater for the entire cathode as well as a dispenser of barium oxide and its reaction products with molybdenum to the cathode members. A life test on an experimental tube of this type showed only 3 per cent. of the barium oxide lost from the cathode after nearly 24,000 hrs. of operation. Another tube, after 30,000 hrs. of operation, gave an electron emission of 3.21 A/cm.<sup>2</sup> at 760° C. cathode temperature.



[By courtesy of A. W. Hull of the General Electric Company, Schenectady.]

### The dispenser cathode

A special correspondent has, on his return from a study trip, published an interesting article in the Swedish trade periodical *Teknisk Tidskrift* on "The Balkans as a Market for Chemicals." The Balkan countries' total annual demand for chemicals may, according to this correspondent, be computed at some 800 million crowns, and at least 550 million crowns' (about £32,500,000) worth of chemicals will have to be imported. The chemical industry of Yugoslavia is, despite the country's riches of forests, minerals, water power and vital raw materials, of little importance. The nitro-chalk and electro-thermal industries are, however, highly developed, and the country has a sulphur industry of some significance. Rumania is in a more advanced state as far as chemical industry is concerned; pharmaceutical products account for 6 per cent. and tanning materials for 6.3 per cent. of the chemical imports. The smallest chemical industry is found in Bulgaria, and the country offers a big market for foreign drugs and medicines which represent 18 per cent. of the value of chemical imports. In Greece's production of chemicals, fertilisers play the largest part. In Turkey a number of chemical factories are in course of erection, as part of the current industrialisation scheme. Pharmaceutical articles here amount to 18 per cent. of the chemical import trade.

\* Reprinted from an article by Dr. C. J. Overbeck, Associate Professor of Physics, North-Western University, Evanston, Ill., on "Some Recent American Advances in Apparatus," (*J. Sci. Instr.*, 1940, 17, 1).

## General News

## From Week to Week

A NEW LACQUER FACTORY will shortly be opened on Clydeside. The new factory will absorb some of the city's unemployed, and will give local consumers their supplies at their own doors.

BAKELITE LIMITED have acquired the works and business of Warerite Limited, of Ware, Herts, who have been engaged in the manufacture of synthetic resin laminated sheet materials.

BOOTS PURE DRUG CO., LTD., have made an offer to the Trent Navigation Committee of the Nottingham City Council to purchase a piece of land 4,390 sq. yds. in area, at the Trent Lane Depot. The Committee recommend the Council to approve the sale.

A REPORT ISSUED by the Ministry of Health reveals that the death rate from cerebro-spinal fever has been reduced from between 50 and 60 per cent. to 10 per cent. by the practice of chemotherapy with the aid of the new sulphanilamide drug M and B 693.

OWING TO THE EXPANSION of their sales organisation in the Manchester area, the Brush Electrical Engineering Co., Ltd., have opened new offices at Daimler House, Wilmslow Road, Rusholme, Manchester 14. (Telephone: Rusholme 2205/7). The offices at Haworth Buildings, Cross Street, Manchester, have been vacated.

SIR CECIL A. COCHRANE, chairman of the Newcastle-upon-Tyne and Gateshead Gas Company, in his address to the company's ordinary meeting recently, said that in view of Government requirements, plants for extracting benzol from gas at those of their works which were not thus equipped were being erected by the company.

TWENTY-SEVEN WORKMEN who went on strike at the Yorkshire Copper Works, Ltd., Barrhead, on February 14, were, at the Paisley Sheriff Court on February 29, sued for damages of £1 each by their employers on the ground of breach of contract. The firm contended that the men failed to observe the conditions of employment set down in notices posted in their works, one of which provided that one week's notice should be given in writing by either side before the contract could be terminated. The firm further alleged that the workmen concerned terminated their employment without justification, and the employers sustained inconvenience and expense which they moderately estimated at £1 per man. The men went on strike for an increase of 2d. per hour. On behalf of the men, a representative of the National Union of General Workers asked that the cases might be adjourned for a fortnight, and Sheriff Hamilton agreed to this course being taken.

### Foreign News

THE PRODUCTION OF METHANOL in the United States during 1939 amounted to 4,659,589 gallons of crude and 34,255,699 gallons of synthetic, according to data prepared by the Bureau of the Census. Crude methanol production in 1938 totalled 4,170,096 gallons and the synthetic variety 26,031,169 gallons.

NEW CAPITAL INVESTMENTS in the Swedish chemical industry in 1939 totalled 12,024,000 kroner, of which 7,242,000 kroner was paid up. Twenty-two new companies were formed, with an aggregate capital of 446,000 kronor, while seventeen existing companies increased their capital by 11,578,000 kronor newly subscribed.

THE WHOLESALE PRICE INDEX for manufactured chemicals in Denmark (100 = prices in 1935) rose from 105 in March-August, 1939, to 111 in September and 136 in December. In Norway (100 = prices in 1938) the chemical price index figure rose from 96.8 in August to 143.7 in December, particularly sharp increases being noted in salt and sodium carbonate.

THE FIRST PHOSPHATE PLANT in Brazil, at Ipanema, in the State of Sao Paulo, some 80 miles west of the capital on the Sorocabana railway, was formally inaugurated recently by the Brazilian President. The plant now installed has a 24-hour capacity of 250 tons of mineral with an output of 50 tons of 41 per cent. concentrate. The existence of phosphate deposits in this locality has long been known and plans for their exploitation were made in 1929. In 1936 practical action toward this end began, when the deposits passed from the Brazilian Ministry of War to the Ministry of Agriculture, the purpose being to use and market the product in the form of fertiliser.

GERMANY, it is reported, is carrying out experiments on the use of formic acid in the conservation of silage.

FISH OILS ARE TO BE WORKED UP to high-grade aviation lubricants in a process which has been developed by the Japan Oil and Fat Company and will be operated in a factory to be built at Amagasaki.

ACCORDING TO GERMAN PAT. 681,859, alcoholic solutions of phosphorus can be stabilised by the addition of ascorbic acid (vitamin C). The solutions stabilised in this way find therapeutic applications.

BY ORDER OF THE Reich Chemical Board, retail trade in the following products is now prohibited in Germany: turpentine, camphor, tannin, bismuth salts, agar-agar, natural resins and gums, technical casein, essential oils, vegetable waxes and beeswax.

ACCORDING TO FINAL Government estimates the all-India castorseed crop for 1939-40 extends over 1,000,000 acres and totals 94,000 tons. Last year's revised estimate was 1,198,000 acres, and 111,000 tons. The condition of the crop is stated to be fairly good.

OFFICES AND LABORATORY at 55 Vandam Street, New York, have been opened by the recently-formed Saint Denis, Kuhlmann, Saint-Clair Dyestuffs Corporation, to enable them to act as direct selling agents in the U.S.A. for the three chief French dyestuffs manufacturers.

AN ORDER HAS BEEN ISSUED annulling all British patent rights within the frontiers of Germany, the *Politiken* reports. It is made clear that this is to be regarded as a reprisal for the British withdrawal of German patent rights shortly after the outbreak of war. Should the patentee be residing in Germany, it will be possible for him to protest.

WITH AN ANNUAL OUTPUT of over 300,000 tons the magnesite deposits at Tashikiao (Manchukuo) are among the most important in the world. About 60 per cent. of the output is exported to Europe and America while Japan takes the balance. Reserves of ore in this region are estimated at 5 milliard metric tons. Other extensive magnesite deposits are being worked in Southern Manchukuo, although exploitation in this area is hindered by transport difficulties. The output is chiefly absorbed by the Nippon Magnesia Chemical Company, which manufactures magnesia bricks and calcined magnesia.

WITH INCREASES IN OUTPUT of several minerals, the production value of the New South Wales mineral industry reached £16,500,000 in 1939, a gain of £1,950,000 compared with the previous year. This is the highest for any year since 1928. Largely owing to the activities of the National Oil Pty. Ltd., at Glen Davis, where it is proposed to produce petrol from shale in the near future, oil shale production increased from 536 tons valued at £337 in 1938 to 6,600 tons valued at £3,600 in 1939. Production for future years is expected to be on a very large scale, sufficient to produce at least 10,000,000 gallons of petrol annually.

THERE ARE INDICATIONS that Germany's production of synthetic nitrogen increased markedly in 1939, especially in the second half-year. In addition to requirements for fertiliser purposes, which in peace time absorb the great bulk of the national nitrogen production, increased production of nitrogen has been stimulated by greater technical requirements created by war conditions. The extent to which these technical requirements have been expanded is suggested by the action of the Reich Government soon after the outbreak of war in placing restrictions on the consumption of nitrogen for fertiliser purposes, so as to reduce national consumption of nitrogenous fertiliser to 75 per cent. of the requirements of 1938-39. This action was the more significant in view of Germany's large capacity for producing nitrogen, of which a great part was idle in normal times. Until recent times it was impossible to utilise much more than half the potential production, owing to insufficient demand. The restrictions upon nitrogenous fertiliser consumption are also significant, in the light of Germany's vigorous campaign for maximum crop production and the aggressive measures taken by the Government, including drastic price reductions, for stimulating fertiliser consumption as a means of augmenting the nation's domestic food supply as against imported foodstuffs.

**THE EXPORT FROM RUMANIA OF MOST METALS**, including mercury, of glycerine, and of several chemicals used in the preparation of hides, boots and shoes, cotton and clothing has been prohibited.

**THE OUTPUT OF CELLULOSE** produced from native reeds in Italy is to be doubled at the factory built last year by the Snaia Viscosa at Torre di Zuino. The concern is also expanding the plant at Cesano Maderno.

**THE RUMANIAN MINISTRY** of National Economy is to place an *ad valorem* tax of 10 to 15 per cent. on crude and refined mineral oil exports, and oil-bearing plants and their products. The tax proceeds are to be spent on national defence.

**BY A DECREE OF FEBRUARY 15**, a general exception to the export prohibition from France on boric acid (other than natural), on the salts and organic compounds of silver, on the carbonate, nitrate and salicylate of bismuth, and on arecoline and its salts has been granted.

**ESTONIAN GLASS MANUFACTURERS** have encountered difficulties in obtaining soda ash from Germany. It is planned, therefore, to establish a domestic producing industry, purchasing equipment in Scandinavian countries and utilising domestic lime and imported salt as raw materials.

**THE FINNISH CELLULOSE MILLS**—Rauma O/Y, Kajaanin Puentavara O/Y and Yhtineet Paperitehdas O/Y—will erect three new sulphite-alcohol distilleries with a total capacity of 7,000 tons. The present annual output capacity of the existing three wood alcohol distilleries in Finland—at Manta, Lievesuo and Tainioinkoski—is approximately 2,000 tons.

**THE MUNICIPAL COUNCIL OF SIBENIK**, Yugoslavia, has adopted a scheme for the resumption of the working of the salt-pits of Lake Zablač, which provides for an annual output of 8,000,000 kg. The Mines d'Antimoine de Podrinje S.A. is to erect a flotation plant. The company produced about 416 tons of antimony in the first eight months of 1939. The mine of the Lissa S.A. is also to erect a flotation plant.

**GERMANY HAS BEEN GIVING** special consideration to stimulating the potash trade in the annexed territories of Austria, Poland and Czechoslovakia, in order to offset, partially at any rate, the heavy losses in overseas trade under war conditions. Prices of potash fertilisers have been considerably reduced in the Czechoslovak area, and concessions granted in freight-rates, with a view also to encouraging agricultural production.

**THE VALUE OF IMPORTS INTO SWEDEN** of chemicals and drugs (excluding fertilisers) during the first nine months of 1939 amounted to 59,935,000 kronor, of which Germany supplied 24,052,000 kronor, Great Britain 6,847,000, and the U.S.A. 5,635,000. Exports under this heading during the same period were valued at 42,872,000 kronor, of which 8,159,000 kronor went to Great Britain, 3,707,000 to Germany and 1,448,000 to the U.S.A.

**INFORMATION REGARDING THE ANALYSES** and other characteristics of nearly 500 crude oils from various Texas fields is given in a report published by the Bureau of Mines, U.S. Department of the Interior. The State of Texas at present produces about 40 per cent. of the total output of petroleum in the United States from a very large number of oil fields. Since the oils from these fields vary widely in characteristics there is a widespread interest in their analyses. The Bureau of Mines has collected 479 samples, some from individual wells, others (composite samples) from 2 to 100 wells in some fields. The analyses are tabulated in summary form in the paper, giving data on sources of samples and characteristics of the crude oils, and on the distillates obtained from the samples by the Bureau of Mines Hempel analysis.

**THE LINSEED OIL SHORTAGE** has been acute for some time in Germany, as only about 5 per cent. of the domestic requirements are home-produced. Synthetic paint materials, therefore, are now more and more replacing linseed oil. The paint industry's consumption of basic materials derived from cellulose and artificial resins amounted to 11,800 metric tons in 1936, out of a total of 32,410 tons used by all industries. Glyptal and alkyd resins are being used as substitutes for linseed oil. An entire series of materials is coming into use purely to replace linseed oil and other natural oils and fats. Lacquers made of chlorinated rubber, coumarone resin, and phenolic resins are being tested. It is reported that chlorinated rubber is well fitted for the production of hard types of lacquer which resist the action of sea-water. Ethyl and benzyl cellulose have also been used for the same purpose.

**CHILEAN GLACIAL ACETIC ACID** imports for 1938 were 24,483 kg., against 50,518 kg. in 1937. Although Germany was the chief supplier, Britain's supplies in the period increased tenfold, from 461 to 4,508 kg.

**OWING TO RAW MATERIAL SHORTAGE** (sand and soda from Germany), the Danish glass works, A/S Holmegaard Glasvaerk, has been compelled to reduce production, notably of milk bottles, the output of which is reduced by 50 per cent.

**THE LATVIAN CHEMICAL MANUFACTURING COMPANY**, A/G Rutenberg, till recently the possession of a repatriated German family, has been taken over by a Latvian co-operative firm, backed by the Central Latvian Dairy Association.

**THE PROPERTIES OF TRISODIUM PHOSPHATE** as a kier boiling assistant have been investigated at the University of Bombay. It is alleged that the sale of trisodium phosphate has expanded in the Indian textile industry but no consumption figures are available.

**IT IS REPORTED FROM** the office of the American Commercial Attaché, Berlin, that Germany's plastics are manufactured in about 1,500 plants of which about one-half are in the Rhineland and Westphalia and one-third in Thuringia. Most of these plants are small. A machinery works in Stuttgart is building presses with welded frame construction with a pressing capacity up to 1,000 metric tons but other companies still keep within the customary limit of about 300 tons for such constructions. While the smaller presses used are mechanical, the larger units are hydraulic. The world's largest press for moulding plastics was built by a factory on the lower Rhine.

## Forthcoming Events

**A JOINT MEETING** of the Plastics Group of the Society of Chemical Industry and the London Section of the Institution of the Rubber Industry will be held on March 11, at 7.15 p.m., in the Northumberland Rooms, Northumberland Av., London, W.C.2, when a paper entitled "The Chemist and Electrical Insulation," will be presented by Mr. L. Massey, M.Sc., Tech. (of Metropolitan-Vickers Electrical Co.).

**A LECTURE OF THE HULL CHEMICAL AND ENGINEERING SOCIETY** will be held in the Department of Zoology, University College, Hull, on March 12, at 6 p.m. Professor A. C. Hardy will speak on "Recent Developments in Oceanographic Research." An exceptional opportunity is afforded to see the experimental trawls and other apparatus which Professor Hardy and his co-workers have devised.

**AT THE ROYAL INSTITUTION**, 21 Albemarle Street, London, W.1, on March 14, at 3 p.m., Sir Frederick Keeble will deliver a lecture on "Plant Hormones"; on March 15, at 5 p.m., he will address the Institution on "Agriculture and National Well-Being."

**IT IS PROPOSED** to hold two meetings of the Electrodepositors' Technical Society in March and April respectively, at which such papers as are available at the time will be presented and discussed. The first of these meetings will take place on March 18, at 7.15 p.m., at the Northampton Polytechnic, St. John Street, London, E.C.1. It is expected that papers will be presented on Filtration Plant and on the Pickling of Steel.

**A MEETING OF THE PLASTICS GROUP** of the Society of Chemical Industry will be held on the evening of March 19 at Burlington House, London, W.1. The paper to be presented on this occasion is "The Dielectric Behaviour of Some Thermoplastics," by Dr. Hartshorn, Mr. Rushton and Mr. Megson. Details of the hour of assembly, etc., will be forthcoming later.

**A JOINT MEETING** of the London and South-Eastern Counties Section of the Institute of Chemistry and the London and Home Counties Branch of the Institute of Physics will be held on March 19 at 7.30 p.m., in the Lecture Theatre of the Royal Institution, 21 Albemarle Street, Piccadilly, London, W.1 (by kind permission of the Officers), when a lecture will be given on "Colour Photography" by Dr. D. A. Spencer, of the Research Laboratories, Kodak, Ltd., Past-President of the Royal Photographic Society.

**THE SEVENTH MEETING** of the Society of Chemical Industry, London Section, will be held on April 1, at 5.30 p.m. in the Rooms of the Chemical Society, Burlington House, London, W.1. A paper entitled "A Study of the Chemical Composition of Wood Smoke," will be presented by Mr. A. E. J. Pettef, B.A. (Oxon.).

## Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2; at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

### Applications for Patents

PROCESSES FOR EXTRACTING AND CONCENTRATING SULPHUR DIOXIDE.—S. A. des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny and Cirey. (France, Oct. 16, '39.) 2206.

MANUFACTURE OF AZO-DYESTUFFS and intermediate products therefor.—Soc. of Chemical Industry in Basle. (Switzerland, Feb. 9, '39.) 2063; (Switzerland, Jan. 18.) 2064.

REFINING OF LIQUID HYDROCARBONS.—South Metropolitan Gas Co., P. C. Bishop, R. A. Procter, and R. F. Twist. 2233.

CATALYTIC TREATMENT OF HYDROCARBONS.—Standard Oil Development Co. (United States, March 10, '39.) 2263; (United States, April 3, '39.) 2264.

MANUFACTURE OF FLUORESCENT PAINTS, coatings, plastic masses, etc.—Technical Industries (Manufacturing), Ltd., J. P. Brennan, and G. F. Brennan. 1990.

DEWAXING OF MINERAL OIL.—Texaco Development Corporation. (United States, Feb. 11, '39.) 2014.

TREATMENT OF ACETIC ACID.—Usines de Melle. (France, March 4, '39.) 2395.

UREA FORMALDEHYDE ADHESIVES.—Aero Research, Ltd., and C. A. A. Rayner. 2849.

DIRECT PRINTING and dyeing of materials.—American Cyanamid Co. (United States, Feb. 25, '39.) 2692.

COMPOSITE MATERIAL from wood and synthetic resins.—Burt, Boulton, and Haywood, Ltd., and F. J. E. China. 2555.

PROCESS AND APPARATUS for the dehydration of alcoholic solutions.—Celec Corporation, Ltd., and S. M. Phillips. 2664.

PREPARATION OF ORGANIC COMPOUNDS.—Colgate-Palmolive-Peet Co. (United States, Feb. 11, '39.) 2541.

TREATMENT OF MAGNESIUM and its alloys.—Dow Chemical Co. (United States, Feb. 25, '39.) 2459.

PROCESS FOR CARRYING OUT OXIDATION REACTIONS.—J. G. Fife (N.V. de Bataafsche Petroleum Maatschappij). 2503.

PREPARATION OF FIBROUS CELLULOSE from vegetable materials.—C. J. J. Fox. 2784.

MANUFACTURE OF BROWN POLYAZO DYESTUFFS especially suitable for dyeing leather.—J. R. Geigy A.-G. (Switzerland, Feb. 15, '39.) 2824.

PRODUCTION OF HETEROCYCLIC CARBOXYLIC ACID DERIVATIVES and the resulting products.—J. R. Geigy A.-G. (Switzerland, Feb. 12, '39.) 2825.

PRODUCTION OF DERIVATIVES of sulphonamides.—J. R. Geigy A.-G. (Switzerland, Feb. 12, '39.) 2826.

PROCESS FOR PREPARATION of ZINCHYDROSULPHITE for bleaching vegetable, etc., fibres.—L. Hahn. 2422.

PROCESS FOR DRYING GLUE.—E. H. Hoelscher, and R. S. Tour. 2676.

ELECTRO-CHEMICAL PRODUCTION OF HYDROCARBONS of paraffin series.—S. L. Lightfoot. 2596.

GAS FILTERS.—J. Philip, and Fuse Industries, Ltd. 2551.

PROCESSES FOR IMPROVING CEMENT CLINKER, hydraulic lime, etc. C. Ponoppidan. 2837.

PRODUCTION OF HYDROCARBONS by conversion of carbon-monoxide with hydrogen.—H. E. Potts (N.V. Internationale Kooldwaterstoffen Synthese Maatschappij (International Hydrocarbon Synthesis Co.)). 2406.

METHOD AND APPARATUS FOR MAKING SOAP.—Refining, Inc. (May 27, '38.) (United States, May 28, '37.) 2704.

FLOCCULATION OF SOLIDS suspended in aqueous liquids.—J. O. Samuel, and Unifloc Reagents, Ltd. 2778.

MANUFACTURE OF SPONGE or cellular rubber.—P. Schidowitz, and R. M. Ungar. 2428.

MANUFACTURE OF ENOL-ESTERS and ketones from acetylene derivatives.—Soc. of Chemical Industry in Basle. (Switzerland, Feb. 10, '39.) 2524; (Switzerland, April 27, '39.) 2525; (Switzerland, Jan. 10, '39.) 2526.

MANUFACTURE OF ALIPHATIC NITRATES.—Standard Oil Development Co. (United States, March 30, '39.) 2476.

CONVERSION OF HYDROCARBON OILS in the presence of powdered contact materials.—Standard Oil Development Co. (United States, Feb. 16, '39.) 2732; (United States, April 15, '39.) 2733.

ELECTRODEPOSITION OF METALS.—W. H. Tait. 2617.

CHEMICAL MANUFACTURE.—M. C. Taylor, and W. C. Gardiner. 2691.

GAS PRODUCERS for motor vehicles.—Vauxhall Motors, Ltd., A. Taub, M. Platt, and H. E. Biraben. 2489.

METHOD OF PREPARING ALBUMEN from naturally and artificially prepared solutions, particularly blood.—P. I. Voskresensky, and M. V. Sheremet. 2677.

MANUFACTURE OF (HALO-ARYLOXY-ALKYL) (HALO-ALKYL) ETHERS.—A. Abbey (Dow Chemical Co.). 3126.

INSECTICIDAL COMPOSITIONS.—A. Abbey (Dow Chemical Co.). 3127.

ORGANIC NITROGEN COMPOUNDS and their application.—A. W. Baldwin, D. Hey, M. A. T. Rogers, and Imperial Chemical Industries, Ltd. 3001.

DISPENSING AGENTS.—American Cyanamid Co. (United States, March 3, '39.) 3072.

MANUFACTURE OF PARASITICIDES.—F. W. Berk and Co., Ltd. (Endowment Foundation). 3076.

TREATMENT OF CELLULOSE ACETATE.—British Celanese, Ltd. (United States, Feb. 28, '39.) 3274; (United States, March 24, '39.) 3275.

PRODUCTION OF CELLULOSE COMPOUNDS.—British Celanese, Ltd. (Celanese Corporation of America). 3190.

RESINOUS CONDENSATION PRODUCTS.—British Thomson-Houston Co., Ltd. (United States, Feb. 17, '39.) 2876.

PRODUCTION OF ABSOLUTE ETHANOL from wort or other alcoholic solution.—Celec Corporation, Ltd., and S. M. Phillips. 2991.

PREPARATION OF SUBSTANTIALLY SULPHUR-FREE MANGANESE and manganese alloys.—Consolidated Mining and Smelting Co. of Canada, Ltd. (United States, Feb. 20, '39.) 3128.

PRODUCTION OF SOLUTIONS containing water-soluble resins.—Corn Products Refining Co. (United States, March 18, '39.) 3069.

PRODUCTION OF ALIPHATIC HYDROXY COMPOUNDS.—H. Dreyfus. 2892.

KILNS FOR THE PRODUCTION OF WOOD CHARCOAL, ETC.—L. H. A. Dunker. 3263.

PRODUCTION OF FORMYL-SUBSTITUTED GLYCOLIC ACID DERIVATIVES.—E. I. du Pont de Nemours and Co. (United States, Feb. 17, '39.) 3033.

PRODUCTION OF GLYCOLIC ACID DERIVATIVES.—E. I. du Pont de Nemours and Co. (United States, Feb. 17, '39.) 3092.

MANUFACTURE of *a*-PYRONE CARBOXYLIC ACID AMIDES.—J. R. Geigy A.-G. (Switzerland, Dec. 20, '39.) 2996.

MANUFACTURE of CONDENSATION PRODUCTS.—J. R. Geigy A.-G. (Switzerland, Dec. 23, '39.) 2997.

PURIFICATION OF SILICA SAND.—R. T. Hancock. 2923.

### Complete Specifications Open to Public Inspection

MANUFACTURE of DYESTUFF INTERMEDIATE PRODUCTS.—I. G. Farbenindustrie. July 16, 1938. 22025-6/38.

PROCESS FOR REMOVING ACID COMPONENTS from hydrocarbons or derivatives thereof.—N. V. de Bataafsche Petroleum Maatschappij. July 15, 1938. 35865/38.

INTERPOLYMERS OF UNSYMMETRICAL DICHLOROETHYLENE.—Imperial Chemical Industries, Ltd. July 19, 1938. 4881/39.

PROCESS OF WORKING-UP PRODUCTS, and more particularly crude fatty acids from the catalytic oxidation of hydrocarbons of higher molecular weight.—W. A. Farenholtz, G. Huble, and H. Hubbe (trading as Vereinigte Oelfabriken Hubbe and Farenholtz). May 11, 1938. 11065/39.

PROCESS OF JOINING PARTS made of thermoplastic material.—I. G. Farbenindustrie. April 30, 1938. 11339/39.

PRODUCTION OF ANHYDROUS ALUMINUM SULPHATE.—Monsanto Chemical Co. May 26, 1938. 11340/39.

MANUFACTURE of HIGHLY REFRACTORY MOLENTARS and the like.—I. G. Farbenindustrie. April 30, 1938. 12963/39.

PRODUCTION of ZEIN COMPOSITIONS.—Corn Products Refining Co. July 15, 1938. 13027/39.

MANUFACTURE of SOLUTIONS of aryl arsine oxides.—I. G. Farbenindustrie. May 6, 1938. 13081/39.

MANUFACTURE of 2-HYDROXY-NAPHTHALEN-4-SULPHONIC ACID, and substitution products thereof.—I. G. Farbenindustrie. May 16, 1938. 13686/39.

PRODUCTION and USE of SOLUTIONS of high molecular weight sulphur-containing condensation products.—Rutgerswerke, A.-G. July 14, 1938. 17421/39.

PRODUCTION of A MIXTURE of CALCIUM d-GLUCONATE and calcium 1-iodonate, and to the production of 1-iodonic acid and salts thereof.—C. Pfizer and C. July 20, 1938. 19453/39.

PROCESS for PREPARING COMPOUNDS of MOYBDIC ACID with alkaline earth metals in lump form.—Norddeutsche Chemische Fabrik in Harburg. July 14, 1938. (Cognate Applications, 19801-2/39.) 19800/39.

VITAMIN PREPARATIONS.—I. G. Farbenindustrie. July 11, 1938. (Cognate Application, 19822/39.) 19821/39.

PREPARATION of PHOSPHORESCENT SUBSTANCES.—I. G. Farbenindustrie. July 18, 1938. 20057/39.

PROCESSES AND APPARATUS for the production of carbon disulphide.—Saurefabrik Schweizerthal. July 21, 1938. 20078/39.

METHOD of DRESSING ORES, coal, and so forth by flotation.—It. Kynth. July 14, 1938. 20127/39.

PROCESSES of PREPARING HEXAMINE-INSULIN COMPOUNDS, and products resulting therefrom.—R. A. Warburton. July 15, 1938. 20300/39.

PROCESS for the DEWAXING of MINERAL OILS.—A/B Separator-Nobel. July 14, 1938. 20310/39.

COMPOSITIONS CONTAINING ORGANIC SULPHATES.—Colgate-Palmolive-Peet Co. July 15, 1938. 20409/39.

MANUFACTURE of DYESTUFFS of the phthalocyanine series.—I. G. Farbenindustrie. July 14, 1938. (Cognate Application, 20434/39.) 20433/39.

METHOD OF PRODUCING MIXTURES for the rubber and related industries.—Naftolen-Ges. zur Verwertung der Rostler-Mehner-Schen Verfahren. July 15, 1938. 20540/39.

MANUFACTURE OF DYESTUFFS of the phthalocyanine series.—I. G. Farbenindustrie. July 15, 1938. (Cognate Application, 20553/39.) 20552/39.

PROCESSES OF PRODUCING OR PREPARING A CONCENTRATE of naturally occurring vitamin E and/or antioxidant from a vegetable oil, and the concentrate resulting therefrom.—General Mills, Inc. July 18, 1938. 20568/39.

TREATMENT OF HYDROCARBON OILS.—Standard Oil Co. (Indiana). July 16, 1938. 20656/39.

OXIDATION OF CELLULOSE.—Kodak, Ltd. July 15, 1938. 20683/39.

MANUFACTURE OF DISAZO DYESTUFFS.—J. R. Geigy A.-G. July 19, 1938. 20728/39.

GLUCOSIDIC COMPOUNDS.—A. Chwala. July 15, 1938. (Cognate Applications, 20793-4/39.) 20792/39.

MANUFACTURE OF VAT-DYESTUFFS.—Soc. of Chemical Industry in Basle. July 20, 1938. (Cognate Application, 20961/39.) 20960/39.

MANUFACTURE OF UREA ARTIFICIAL RESINS.—Albert Products, Ltd. July 19, 1938. 20982/39.

MANUFACTURE OF ESTERS.—Soc. of Chemical Industry in Basle. July 21, 1938. (Cognate Applications, 21078-9/39.)

TREATMENT OF IRON-SILICON ALLOYS.—Fides Ges. für die Verwaltung und Verwertung von Gewerblichen Schutzrechten. July 20, 1938. 21138/39.

PROCESS FOR REMOVING ACID COMPONENTS from hydrocarbons or derivatives thereof.—N. V. de Bataafsche Petroleum Maatschappij. July 15, 1938. (Divided out of 35865/38.) 30581/39.

### Specifications Accepted with Date of Application

PRODUCTION AND USE OF ACCELERATORS for rubber vulcanisation. Monsanto Chemical Co. Oct. 16, 1937. 517,451.

PROCESS AND PLANT FOR THE HYDROLYSIS OF CELLULOSE MATERIALS and the like.—H. M. L. R. Fouque. July 28, 1938. 517,454.

CONVERSION OF ALKALINE-EARTH METAL OXALATES, and the manufacture of alkali metal hydroxides.—I. L. Clifford, and Imperial Chemical Industries, Ltd. July 28, 1938. 517,455.

MANUFACTURE OF AZO PIGMENTS.—E. I. du Pont de Nemours and Co. July 28, 1937. 517,456.

NITROGEN-CONTAINING ORGANIC COMPOUNDS and their application to textiles.—M. A. T. Rogers, and Imperial Chemical Industries, Ltd. July 29, 1938. (Cognate Application, 7098/39.) 517,474.

PREPARATION OF IMPROVED COLOURING MATTERS.—J. L. Moilliet, H. J. Thurlow, and Imperial Chemical Industries, Ltd. July 29, 1938. 517,475.

MANUFACTURE OF SULPHURISED DIHYDROPOLYCYCLIC AROMATIC HYDROCARBONS, and lubricating-compositions containing the same. E. I. du Pont de Nemours and Co. July 29, 1937. 517,582.

METHOD OF PREPARING SILVER HALIDE GELATINE EMULSIONS for the silver dyestuff bleach-out process.—Kodak, Ltd. July 31, 1937. 517,628.

MANUFACTURE OF SOLUBLE NITRO DYESTUFFS, and their application.—A. H. Knight, F. H. Pearnall, and Imperial Chemical Industries, Ltd. Aug. 2, 1938. 517,629.

MANUFACTURE OF COLOURED ORGANIC COMPOUNDS.—J. S. H. Davies, and Imperial Chemical Industries, Ltd. Aug. 2, 1938. 517,630.

ORGANIC NITROGEN COMPOUNDS, and their application.—A. W. Baldwin, M. A. T. Rogers, and Imperial Chemical Industries, Ltd. Aug. 2, 1938. (Cognate Application, 7096/39.) 517,632.

PRODUCTION OF PIGMENTED BASES for the production of lacquers, plastics, and the like.—Binney and Smith Co. Aug. 2, 1937. (Cognate Application, 22890/38.) 517,640.

MANUFACTURE OF AZO-DYESTUFFS.—Soc. of Chemical Industry in Basle. Aug. 7, 1937. 517,642.

MANUFACTURE OF SULPHUR-CONTAINING ORGANIC COMPOUNDS.—S. Ellingworth, F. L. Rose, and Imperial Chemical Industries, Ltd. June 27, 1938. (Divided out of 517,421.) (Cognate Application, 13248/39.) 517,457.

METHOD OF DUST-PROOFING FUEL by spraying viscous waxes and oils thereon.—J. A. Erickson. July 26, 1938. (Divided out of 517,395.) 517,459.

OIL-SOLUBLE RESIN, and method of making same.—I. Rosenblum. March 2, 1938. 517,764.

MANUFACTURE OF FOAM-GENERATING SUBSTANCES.—Pyrene Co., Ltd., and A. F. Ratzer. May 31, 1938. 517,767.

MANUFACTURE OF HYDROCARBON GASES.—T. D. Kelly. June 3, 1938. (Cognate Application, 36159/38.) 517,668.

DYES, and photographic silver halide emulsions containing the same.—Kodak, Ltd. June 4, 1937. 517,769.

PRODUCTION OF FOAMS.—Pyrene Co., Ltd. (Pyrene Manufacturing Co.). June 25, 1938. 517,812.

MANUFACTURE AND PRODUCTION OF SYNTHETIC RESINS.—I. G. Farbenindustrie. July 30, 1937. 517,738.

MANUFACTURE OF ACID-PROOF MORTARS.—I. G. Farbenindustrie. Aug. 20, 1937. 517,672.

MANUFACTURE OF 1-AMINO-2-CHLORO (or bromo)-4 (or 6)-nitrobenzene-6 (or 4)-sulphonic acid.—I. G. Farbenindustrie. Sept. 17, 1937. 517,673.

MANUFACTURE OF FORMALDEHYDE.—Distillers Co., Ltd., and J. Francon. Aug. 3, 1938. 517,740.

MANUFACTURE OF 2-CHLORO (or bromo)-4 (or 6)-nitro-1-amino-benzene-6 (or 4)-sulphonic acid.—I. G. Farbenindustrie. Nov. 20, 1937. 517,674.

PROCESS FOR THE MANUFACTURE OF CONDENSATION PRODUCTS.—I. G. Farbenindustrie. Aug. 3, 1937. 517,684.

MANUFACTURE OF d-HALOGEN-VINYL METHYL KETONES.—I. G. Farbenindustrie. Aug. 3, 1937. 517,685.

IMPROVING THE STABILITY TO HEAT of shaped polyvinyl chloride and the like.—W. W. Groves (I. G. Farbenindustrie.) Aug. 4, 1938. 517,689.

PROCESS FOR THE MANUFACTURE OF  $\beta$ -INDOLE ACETIC ACIDS.—I. G. Farbenindustrie. Aug. 4, 1937. (Cognate Application, 23095/38.) 517,692.

METHOD OF PRODUCING SOLUBLE BENZYL ETHER OF DEXTRAN.—G. L. Stahly, and W. W. Carlson. Feb. 26, 1938. 517,820.

PRODUCTION OF PURE HYDROCARBONS of the benzene series by distillation, and apparatus for carrying out this process.—Niederschlesische Bergbau A.-G. Aug. 5, 1937. (Cognate Application, 23219/38.) 517,822.

PRODUCTION OF TITANIUM DIOXIDE PIGMENTS.—British Titan Products Co., Ltd. Aug. 7, 1937. 517,742.

PRODUCTION OF ORGANIC ACIDS by fermentation.—J. Anthony and Co., Ltd. (W. Lorenz). Aug. 6, 1938. 517,793.

PREPARATION OF CATALYSTS.—Synthetic Oils, Ltd., and W. W. Myddleton. Aug. 6, 1938. 517,794.

METHOD OF PREPARING QUINUCLIDINE, and derivatives thereof.—Kustel Tvoronica Kemisko-Farmaceutské Proizvoda D.D., and V. Frelog. Aug. 6, 1937. 517,830.

COATING OF ARTICLES with phenolformaldehyde resins, and the articles thus coated.—A. H. Stevens (Heresite and Chemical Co.). Aug. 8, 1938. 517,833.

APPARATUS FOR CATALYTIC REACTIONS.—Hercules Powder Co. Aug. 30, 1937. 517,744.

MANUFACTURE OF AMINO-HYDRAZINES.—Soc. of Chemical Industry in Basle. Aug. 14, 1937. (Addition to 475,627.) 517,747.

PRODUCTION OF ARTIFICIAL THREADS, filaments, and formations of cellulose ethers and esters, and of regenerated cellulose.—F. D. Lewis. Aug. 15, 1938. 517,886.

PRODUCTION OF FILMS, foils, filaments, or the like of regenerated cellulose.—Schlesische Zellwolle, A.-G. Aug. 17, 1937. (Addition to 517,047.) 517,891.

PRODUCTION OF STARCH CONVERSION PRODUCTS, and the improved products resulting therefrom.—A. H. Stevens (Staley Manufacturing Co., A. E.). Aug. 16, 1938. 517,892.

MANUFACTURE OF ABRAZIVE ALUMINA.—Chemical Construction Corporation. Sept. 22, 1937. 517,858.

CATALYTIC POLYMERISATION OF OLEFINES.—I. G. Farbenindustrie. Dec. 6, 1937. 517,799.

DISTILLATION OF CRUDE OIL PETROLEUM or tars obtained from coal and shale.—R. Adler. April 29, 1938. 517,892.

PROCESS FOR THE MANUFACTURE OF ISOBUTANE from normal butane.—N. V. de Bataafsche Petroleum Maatschappij. Aug. 18, 1937. (Divided out of 23102/38.) 517,758.

PRODUCTION OF COMPOSITE TITANIUM PIGMENTS.—E. I. du Pont de Nemours and Co. May 27, 1937. 517,913.

MANUFACTURE OF AZO-DYESTUFFS.—Soc. of Chemical Industry in Basle. Sept. 18, 1937. (Cognate Applications, 20493/38 and 20494/38.) 517,918.

TREATMENT OF TEXTILE MATERIALS.—J. G. Evans, R. J. Smith, and Imperial Chemical Industries, Ltd. July 15, 1938. 518,072.

ARTICLES AND MATERIALS composed of reinforced synthetic resin or like plastic substances.—R. Young, and S. Rosenfeld. July 25, 1938. 518,074.

PRODUCTION OF DERIVATIVES of *p*-amino-benzene-sulphonamide. N. V. Orgachemia. Aug. 6, 1937. 517,919.

MANUFACTURE OF COMPOUNDS having the action of vitamin E.—Soc. of Chemical Industry in Basle. Aug. 10, 1937. (Cognate Application, 23592/38.) 517,932.

WORKING-UP AMMONIACAL SOLUTIONS of heavy metals.—I. G. Farbenindustrie. Sept. 14, 1937. 517,935.

MANUFACTURE OF ETHERS of phenylmethylcarbinol and its homologues, and the decomposition thereof.—Distillers Co., Ltd., H. M. Stanley, G. Minkoff, and J. E. Youell. Aug. 10, 1938. 517,934.

MANUFACTURE OF DERIVATIVES of the saturated and unsaturated eicosanopolypolyhydrophenanthrene series.—Soc. of Chemical Industry in Basle. Aug. 12, 1937. (Cognate Application, 23711/38.) 517,942.

MANUFACTURE OF ALCOHOLS of the saturated or unsaturated eicosanopolypolyhydrophenanthrene series, or derivatives thereof. Soc. of Chemical Industry in Basle. Aug. 16, 1937. (Cognate Application, 23714/38.) 517,943.

POLYMERS OF METHACRYLIC ACID METHYL ESTER.—Rohm and Haas A.-G. Sept. 29, 1937. 517,948.

HYDROGENATION OF OITICICA OIL.—E. I. du Pont de Nemours and Co. Aug. 11, 1937. 517,949.

MANUFACTURE OF SYNTHETIC RUBBER-LIKE MASSSES.—I. G. Farbenindustrie. Aug. 11, 1937. 517,951.

HYDROCARBON OIL CONVERSION.—N. V. Nieuwe Oetrooi Maatschappij. Sept. 28, 1937. 518,024.

STABILISATION OF POLYVINYL RESINS.—Kodak, Ltd. Aug. 14, 1937. 518,099.

INCORPORATING PHOSPHATIDES into edible paste goods and bakery products.—M. F. Niescher. Sept. 10, 1937. 518,103.

## Weekly Prices of British Chemical Products

**A**FIRM tone prevails in the general chemical market and a steady demand is reported from most departments. A steady flow of deliveries under existing contracts is in evidence and the volume of inquiry for new business has been good. Price conditions on the whole are steady with a number of products showing an upward trend. Higher quotations are now ruling for such items as ammonium carbonate, magnesium chloride, sodium acetate, sodium nitrate and zinc sulphate. Makers of tartaric acid advise their quotation, which continues nominal, at 1s. 6½d. per lb. less 5 per cent. discount. Supplies continue to be limited and reserved for regular consumer customers. A fair business has been passing in the market for coal tar products with carbolic acid very strong, the crystals being quoted at 1s. 1d. per lb., and the crude 60's at 3s. 7d. to 3s. 9d. Naphthalene prices are on a nominal basis with available parcels of purified crystals and firelighter quality commanding high rates.

**MANCHESTER.**—In many of the bread-and-butter lines of heavy chemicals, including the alkalis, it is reported on the Manchester market that consumers are mostly well booked and that fresh business at the moment is on no more than moderate lines. There is still, however, a very active inquiry for any odd parcels of bichromates, prussiates and certain other materials that come on to the market. Permanganate and the potash compounds meet with

steady demand at a firm range of prices. In the by-products section carbolic acid, both crude and crystals, are active and there is a steady call for the light distillates, all of which are strong. A feature is the sharply rising tendency in flake naphthalene.

**Glasgow.**—A greater degree of activity is noticeable in the Scottish heavy chemical market during the last few days. An increasing demand for glucose, starch and dextrines has been felt. Paint trade materials are also in demand. Deliveries, however, are still slow and prices remain very firm.

### Price Changes

**Rises:** Aluminium Sulphate, Ammonium Carbonate, Bleaching Powder, Carbolic Acid, Litharge, Magnesite, Magnesium Chloride, Naphthalene, Sodium Acetate, Sodium Nitrate, Sodium Sulphate (Glauber Salts), Sulphuric Acid, Tartaric Acid, Zinc Sulphate.

\* In the case of certain products, here marked with an asterisk, the market is nominal, and the last ascertainable prices have been scheduled. At present all intermediates are included under this head.

### General Chemicals

**Acetic Acid.**—Maximum prices per ton: 80% technical, 1 ton £34 15s.; 10 cwt./1 ton, £35 15s.; 4/10 cwt., £36 15s.; 80% pure, 1 ton, £36 15s.; 10 cwt./1 ton, £37 15s.; 4/10 cwt., £38 15s.; commercial glacial, 1 ton, £44; 10 cwt./1 ton, £45; 4/10 cwt., £46; delivered buyers' premises in returnable barrels, £4 per ton extra if packed and delivered in glass.

**Acetone.**—Maximum prices per ton, 50 tons and over, £49 10s.; 10/50 tons, £50; 5/10 tons, £50 10s.; 1/5 tons, £51; single drums, £52, delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each; delivered in containers of less than 45 gallons but not less than 10 gallons £10 10s. per ton in excess of maximum prices; delivered in containers less than 10 gallons each £10 10s. per ton in excess of maximum prices, plus a reasonable allowance.

\***Alum.**—Loose lump, £8 7s. 6d. per ton, d/d.

\***Aluminium Sulphate.**—About £8 per ton f.o.b. Liverpool.

**Ammonia Anhydrous.**—99.95%, 1s. to 2s. per lb., according to quantity in loaned cylinders, carriage paid; less for important contracts.

**Ammonium Carbonate.**—£32-£36 per ton d/d in 5 cwt. casks.

**Ammonium Chloride.**—Grey galvanising, £18 per ton, in casks, ex wharf. See also Salammoniac.

\***Antimony Oxide.**—£68 per ton.

**Arsenic.**—99/100%, about £25 per ton, ex store.

**Barium Chloride**—98/100%, prime white crystals, £11 10s. 0d. to £13 per ton, bag packing, ex works; imported material would be dearer.

**Bleaching Powder.**—Spot, 35/37%, £10 per ton in casks, special terms for contract.

**Borax, Commercial.**—Granulated, £20 10s. per ton; crystal, £21 10s.; powdered, £22; extra finely powdered, £23; B.P. crystals, £29 10s.; powdered, £30; extra fine £31 per ton for ton lots in free 1-cwt. bags, carriage paid in Great Britain. Borax Glass, lump, £64; powder, £65; in tin-lined cases for home trade only, packages free, carriage paid in Great Britain.

**Boric Acid.**—Commercial granulated, £34 10s. per ton; crystal £35 10s.; powdered, £36 10s.; extra finely powdered, £38 10s.; large flakes, £47; B.P. crystals, £43 10s.; powdered, £44 10s.; extra fine powdered, £46 10s. per ton for ton lots, in free 1-cwt. bags, carriage paid in Great Britain.

**Calcium Bisulphite.**—£7 10s. per ton f.o.r. London.

\***Calcium Chloride.**—GLASGOW: 70/75% solid, £5 12s. 6d. per ton ex store.

**Charcoal Lump.**—£10 to £12 per ton, ex wharf. Granulated £11 to £14 per ton according to grade and locality.

\***Chlorine, Liquid.**—£19 15s. per ton, d/d in 16/17 cwt. drums (3-drum lots); 4½d. per lb. d/d station in single 70-lb. cylinders.

**Chrometan.**—Crystals, 4d. per lb.; liquor, £19 10s. per ton d/d station in drums. GLASGOW: Crystals 4d. per lb. in original barrels.

**Chromic Acid.**—1s. per lb., less 2½%; d/d U.K. GLASGOW: 1s. 0½d. per lb. for 1 cwt. lots.

**Chromic Oxide.**—1s. 2d. per lb., d/d U.K.

**Citric Acid.**—1s. 2d. per lb. MANCHESTER: 1s. 3d.

\***Copper Sulfate.**—Nominal.

**Cream of Tartar.**—100%, £6 2s. to £6 7s. per cwt., less 2½%. Makers' prices nominal, imported material about £170 per ton to quantity, d/d in sellers' returnable casks; imported material would be dearer.

**Formic Acid.**—85%, £14 10s. per ton for ton lots, carriage paid, carboys returnable; smaller parcels quoted at 46s. 6d. to 49s. 6d. per cwt., ex store.

**Glycerine.**—Chemically pure, double distilled, 1,260 s.g., in tins, £3 10s. to £4 10s. per cwt. according to quantity; in drums, £3 2s. 6d. to £3 16s. 0d. Refined pale straw industrial, 56 per cwt. less than chemically pure.

**Hexamine.**—Technical grade for commercial purposes, 1s. 4d. per lb.; free-running crystals are quoted at 1s. 7½d. to 1s. 10½d. per lb.; carriage paid for bulk lots.

**Hydrochloric Acid.**—Spot, 6s. 1½d. to 8s. 7½d. carboy d/d according to purity, strength and locality.

**Iodine.**—Resublimed B.P., 9s. 2d. to 13s. per lb., according to quantity.

**Lactic Acid.**—(Not less than ton lots). Dark tech., 50% by vol., £30 10s. per ton; 50% by weight, £35; 80% by weight, £60; pale tech., 50% by vol., £36; 50% by weight, £42; 80% by weight, £67. One ton lots ex works; barrels returnable.

**Lead Acetate.**—White, £48 to £50, ton lots.

**Lead Nitrate.**—About £44 per ton d/d in casks.

**Lead, Red.**—English, 5/10 cwt., £41 10s.; 10 cwt. to 1 ton, £41 5s.; 1/2 tons, £41; 2/5 tons, £40 10s.; 5/20 tons, £40; 20/100 tons, £39 10s.; over 100 tons, £39 per ton, less 2½ per cent., carriage paid; non-setting red lead, 10s. per ton dearer in each case; Continental material, £1 per ton cheaper.

**Lead, White.**—Dry English, less than 5 tons, £51; 5/15 tons, £47; 15/25 tons, £46 10s.; 25/50 tons, £46; 50/200 tons, £45 10s. per ton, less 5% carriage paid; Continental material, £1 per ton cheaper. Ground in oil, English, 1/5 cwt., £59 10s. 5/10 cwt., £58 10s.; 10 cwt. to 1 ton, £58; 1/2 tons, £56 10s.; 2/5 tons, £55 10s.; 5/10 tons, £53 10s.; 10/15 tons, £52 10s.; 15/25 tons, £52; 25/50 tons, £51 10s.; 50/100 tons, £51 per ton, less 5% carriage paid. Continental material £2 per ton cheaper.

**Litharge.**—1 to 2 tons, £41 per ton.

**Magnesite.**—Calcined, in bags, ex works, about £12 to £15 per ton.

**Magnesium Chloride.**—Solid (ex wharf), £12 per ton.

\***Magnesium Sulphate.**—Commercial, £5 10s. per ton, ex wharf.

**Mercury Products.**—Controlled prices for 1 cwt. quantities: Bichloride powder, 9s. 1d.; bichloride lump, 9s. 8d.; bichloride ammon. powder, 10s. 7d.; bichloride ammon. lump, 10s. 5d.; mercurous chloride, 10s. 11d.; mercury oxide, red cryst., B.P., 12s. 3d.; red levig. B.P., 11s. 9d.; yellow levig. B.P., 11s. 7d.

\***Methylated Spirit.**—61 O.P. industrial, 1s. 5d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities.

\***Nitric acid.**—Spot, £19 to £26 per ton, according to strength, quantity and destination.

**OXalic Acid.**—From £60 per ton for ton lots, carriage paid, in 5-cwt. casks; smaller parcels would be dearer; deliveries slow.

\***Paraffin Wax.**—Nominal.

**Potash, Caustic.**—Liquid, £30 to £35 per ton, according to quantity.

**Potassium Bichromate.**—5½d. per lb. carriage paid. GLASGOW: 5½d. per lb., carriage paid.

**Potassium Chlorate.**—Imported powder and crystals, ex store London, 10d. to 1s. per lb.

**Potassium Iodide.**—B.P., 8s. to 11s. 2d. per lb., according to quantity.

**Potassium Nitrate.**—Small granular crystals, £26 to £29 per ton ex store, according to quantity.

**Potassium Permanganate.**—B.P., 1s. 4d. to 1s. 5½d. per lb.; commercial, £7 9s. 6d. to £8 1s. 6d. per cwt., according to quantity, d/d.

**Potassium Prussiate.**—Yellow, about 1s. 8d. per lb., supplies scarce.

**Sal ammoniac.**—Dog-tooth crystals, £44 per ton; medium, £38; fine white crystals, £16 10s.; in casks, ex store.

**Soda Ash.**—Light 98/100%, £6 2s. 6d. per ton f.o.r. in bags.

**Soda, Caustic.**—Solid, 76/77% spot, £14 per ton d/d station.

**Soda Crystals.**—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

**Sodium Acetate.**—£37 to £40 per ton, ex wharf.

**Sodium Bicarbonate.**—About £10 10s. to £11 10s. per ton, in bags.

**Sodium Bichromate.**—Crystals, 4½d. per lb., net d/d U.K. with rebates for contracts. GLASGOW: 5½d. per lb., carriage paid.

**Sodium Bisulphite Powder.**—60/62%, £16 per ton d/d in 2-ton lots for home trade.

**Sodium Carbonate Monohydrate.**—£20 per ton d/d in minimum ton lots in 2 cwt. free bags.

**Sodium Chlorate.**—£32 to £39 per ton, d/d, according to quantity.

**Sodium Hyposulphite.**—Pea crystals, £16 17s. 6d. per ton for 2-ton lots; commercial, £13 10s. per ton. MANCHESTER: Commercial, £13; photographic, £16 10s.

**Sodium Iodide.**—B.P., for not less than 28 lb., 8s. 10d. per lb.; for not less than 7 lb., 10s. 9d. per lb.

\***Sodium Metasilicate.**—£14 5s. per ton, d/d U.K. in cwt. bags.

**Sodium Nitrate.**—Refined, £9 10s. to £10 per ton for 6-ton lots d/d.

**Sodium Nitrite.**—£18 15s. per ton for ton lots.

**Sodium Perborate.**—10%, £4 10s. per cwt. d/d in 1-cwt. drums.

**Sodium Phosphate.**—Di-sodium, £16 to £17 per ton delivered for ton lots. Tri-sodium, £18 per ton delivered per ton lots.

**Sodium Prussiate.**—From 6d. per lb. ex store.

**Sodium Silicate.**—£2 2s. 6d. per ton, for 4-ton lots.

\***Sodium Sulphate (Glauber Salts).**—£1 10s. per ton d/d.

**Sodium Sulphate (Salt Cake).**—Ground spot, £1 4s. per ton d/d station in bulk. MANCHESTER: £1.

**Sodium Sulphate.**—Solid 60/62%, Spot, £13 15s. per ton d/d in drums; crystals, 30/32%, £9 10s. per ton d/d in casks. MANCHESTER: Concentrated solid, 60/62%, £13; crystals, £9 15s.

\***Sodium Sulphite.**—Pea crystals, spot, £16 per ton d/d station in kegs.

\***Sulphur Precip.**—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.

**Sulphuric Acid.**—168° Tw., £5 7s. to £5 17s. per ton; 140° Tw., arsenic-free, £3 15s. to £4 5s.; 140° Tw., arsenious, £3 7s. 6d.

**Tartaric Acid.**—1s. 6½d. per lb., less 5%, carriage paid for lots of 5 cwt. and upwards. Makers' prices nominal; imported material 2s. 3d. to 2s. 6d. per lb., ex wharf. MANCHESTER: 1s. 6d. per lb.

**Zinc Oxide.**—Maximum prices: White seal, £30 17s. 6d. per ton; red seal, £28 7s. 6d. d/d; green seal, £29 17s. 6d. d/d buyers' premises.

**Zinc Sulphate.**—Tech., about £25, carriage paid, casks free.

### Rubber Chemicals

**Antimony Sulphide.**—Golden, 9½d. to 1s. 6d. per lb., according to quality. Crimson, 1s. 7½d. to 1s. 10½d. per lb.

**Arsenic Sulphide.**—Yellow, 1s. 6d. to 1s. 8d. per lb.

**Barytes.**—Imported material £6 to £9 per ton according to quality.

**Carbon Black.**—About 7d. to 7½d. per lb., according to quantity.

**Carbon Disulphide.**—£29 to £34 per ton, according to quantity, in free returnable drums.

**Carbon Tetrachloride.**—£18 to £53 per ton, according to quantity, drums extra.

**India-rubber Substitutes.**—White, 5½d. to 6½d. per lb.; dark 5½d. to 6d. per lb.

**Lamp Black.**—Imported material is quoted at about £35 to £40 per ton.

**Lithopone.**—30%, £18 17s. 6d. per ton; 60%, £31 to £32 per ton. Imported material would be dearer.

**Sulphur.**—Finely powdered, about £15 per ton, delivered.

**Sulphur Chloride.**—6d. to 8d. per lb., according to quantity.

**Vegetable Black.**—£35 per ton upwards; 28/30%, £15 10s. 6d. 60%, £29, delivered buyers' premises.

**Vermilion.**—Pale or deep, 8s. 5d. per lb., for 7 lb. lots.

**Zinc Sulphide.**—About £63 per ton ex works.

Plus 5% War Charge.

### Nitrogen Fertilisers

**Ammonium Sulphate.**—Per ton in 6-ton lots d/d farmer's nearest station, March/June, £9 6s.

**Calcium Cyanamide.**—£12 10s. for 5-ton lots per ton net f.o.r. or ex store, London. Supplies small.

“Nitro-Chalk.”—£8 18s. per ton, in 6-ton lots, d/d farmer's nearest station, January/June delivery.

**Concentrated Complete Fertilisers.**—£11 18s. to £12 4s. per ton in 6-ton lots, d/d farmer's nearest station.

**Ammonium Phosphate Fertilisers.**—£11 14s. to £16 6s. per ton in 6-ton lots, d/d farmer's nearest station.

### Coal Tar Products

**Benzol.**—Industrial (containing less than 2% of toluol), 2s. to 2s. 1d. per gal., ex works, nominal.

**Carbolic Acid.**—Crystals, 1s. 1d. per lb.; Crude, 60's, 3s. 7d. to 3s. 9d., according to specification. MANCHESTER: Crystals, 1s. 3d. per lb., d/d; crude, 4s. to 4s. 3d. naked, at works.

**Cresote.**—Home trade, 5d. per gal., f.o.r., makers' works; exports 6d. to 6½d. per gal., according to grade. MANCHESTER: 4½d. to 7d.

**Cresylic Acid.**—99/100%, 2s. 11d. to 3s. 3d. per gal., according to specification. MANCHESTER: Pale, 99/100%, 3s.

**Naphtha.**—Solvent, 90/100°, 1s. 8d. to 1s. 9d. per gal.; solvent, 95/100°, 1s. 11d. to 2s., naked at works; heavy 90/100°, 1s. 3d. to 1s. 5d. per gal., naked at works, according to quantity. MANCHESTER: 90/100°, 1s. 9d. to 1s. 11d. per gal.

**Naphthalene.**—Crude, whizzed or hot pressed, £10 to £11 per ton; purified crystals, £18 to £20 per ton in 2-cwt. bags. LONDON: Fire lighter quality, £6 to £7 per ton ex works. MANCHESTER: Refined, £23.

**Pitch.**—Medium, soft, 35s. per ton, f.o.b. MANCHESTER: 37s. 6d., f.o.b. East Coast.

**Pyridine.**—90/140°, 19s. to 20s. per gal.; 90/160°, 16s. to 18s. 6d.; 80/180°, 3s. 9d. to 4s. 6d. per gal., f.o.b. MANCHESTER: 17s. 6d. to 20s. per gal.

**Toluol.**—90%, 2s. 3d. per gal.; pure, 2s. 5d., nominal. MANCHESTER: Pure, 2s. 5d. per gal., naked.

**Xylool.**—Commercial, 2s. 7d. per gal.; pure, 2s. 9d. MANCHESTER: 2s. 11d. per gal.

### Wood Distillation Products

**Calcium Acetate.**—Brown, £8 to £8 10s. per ton; grey, £12 to £13. MANCHESTER: Grey, £14.

**Methyl Acetone.**—40/50%, £42 per ton.

**Wood Creosote.**—Unrefined, 1s. to 1s. 3d. per gal., according to boiling range.

**Wood Naphtha, Miscible.**—3s. 7d. to 4s. per gal.; solvent, 4s. to 4s. 6d. per gal.

**Wood Tar.**—£5 to £6 per ton, according to quality.

### \*Intermediates and Dyes

**Aniline Oil.**—Spot, 8d. per lb., drums extra, d/d buyer's works.

**Aniline Salts.**—Spot, 8d. per lb., d/d buyer's works, casks free.

**Benzaldehyde.**—1s. 10d. per lb., for cwt. lots, net packages.

**Benzidine, HCl.**—2s. 7d. per lb., 100% as base, in casks.

**Benzoid Acid.**—1914 B.P. (ex toluol).—1s. 11d. per lb., d/d buyer's works.

**m-Cresol.**—98/100%, 1s. 8d. to 1s. 9d. per lb. in ton lots.

**o-Cresol.**—30/31° C.—8d. to 9d. per lb. in ton lots.

**p-Cresol.**—34/35° C.—1s. 8d. to 1s. 9d. per lb. in ton lots.

**Dichloraniline.**—2s. 1½d. to 2s. 7d. per lb.

**Dimethylaniline.**—Spot, 1s. 7½d. per lb., package extra.

**Dinitrobenzene.**—8d. per lb.

**Dinitrochlorobenzene, Solid.**—£79 5s. per ton.

**Dinitrotoluene.**—48/50° C., 9d. per lb.; 66/68° C., 11½d.

**Diphenylamine.**—Spot, 2s. 3d. per lb.; d/d buyer's works.

**Gamma Acid.**—Spot, 4s. 4½d. per lb., 100%, d/d buyer's works.

**H Acid.**—Spot, 2s. 7d. per lb.; 100%, d/d buyer's works.

**Naphthionic Acid.**—1s. 10d. per lb.

**β-Naphthol.**—£97 per ton; flake, £94 8s. per ton.

**α-Naphthylamine.**—Lumps, 1s. 1d. per lb.

**β-Naphthylamine.**—Spot, 3s. per lb.; d/d buyer's works.

**Neville and Winther's Acid.**—Spot, 3s. 3½d. per lb. 100%.

**o-Nitraniline.**—4s. 3½d. per lb.

**m-Nitraniline.**—Spot, 2s. 10d. per lb. d/d buyer's works.

**p-Nitraniline.**—Spot, 1s. 10d. to 2s. per lb., in 90-gal. drums.

**Nitrobenzene.**—Spot, 4½d. to 5½d. per lb., in 90-gal. drums, drums extra, 1-ton lots d/d buyer's works.

**Nitronaphthalene.**—10d. per lb.; P.G., 1s. 9½d. per lb.

**Sodium Naphthionate.**—Spot, 1s. 11d. per lb. 100%, d/d buyer's works.

**Sulphanilic Acid.**—Spot, 8½d. per lb. 100%, d/d buyer's works.

**o-Toluidine.**—11d. per lb., in 8/10 cwt. drums, drums extra.

**p-Toluidine.**—2s. per lb., in casks.

**m-Xylylne Acetate.**—4s. 5d. per lb., 100%.

### Latest Oil Prices

LONDON.—March 7.—For the period ending March 30, per ton, net, naked, ex mill, works or refinery, and subject to additional charges according to package and location of supplies:—LINSEED OIL, raw, £42 10s. RAPESEED OIL, crude, £44 5s. COTTONSEED OIL, crude, £31 2s. 6d.; washed, £34 5s.; refined edible, £35 12s. 6d.; refined deodorised, £36 10s. SOYA BEAN OIL, crude, £33; refined deodorised, £37. COCONUT OIL, crude, £28 2s. 6d.; refined deodorised, £31 7s. 6d. PALM KERNEL OIL, crude, £27 10s.; refined deodorised, £30 15s. PALM OIL, refined deodorised, £33. GROUNDNUT OIL, crude, £35 10s.; refined deodorised, £40. WHALE OIL, crude hardened, 42 deg., £30 10s.; refined hardened, 42 deg., £33. ACID OILS.—Groundnut, £24; soya, £22; coconut and palm kernel, £22 10s. ROSIN, 25s. to 35s. per cwt., ex wharf, according to grade. TURPENTINE, 54s. 9d. per cwt., spot, American, including tax, ex wharf, barrels, and ex discount.

## Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

### Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an \*—followed by the date of the Summary, but such total may have been reduced.)

RYSAN, LTD., London, W., manufacturers of fluids for fire extinction, etc. (M., 9/3/40.) Feb. 24, £872 debenture, to J. H. Sankey & Son, Ltd., London; general charge.

### County Court Judgments

STIRLAND, MR., Redlands, Clifton Road, Chesham, chemical manure manufacturer. (C.C.J., 9/3/40.) £14 5s. 7d. Jan. 17.

ALLIED CHEMICAL CO., LTD., 35 Boston Road, East Ham, chemical manufacturers. (C.C.J., 9/3/40.) £17 6s. 2d. Dec. 20.

LAINGS (CHEMISTS), LTD., 40 Wellclose Square, E.1, chemical dealers. (C.C.J., 9/3/40.) £18 9s. 3d. Dec. 29.

### Receivers Ceasing to Act

MOULDCAST, LTD., London, W.C., manufacturers of plastics. (R.C.A., 9/3/40.) H. B. C. Smith. Feb. 19.

### Partnership Dissolved

MACTAGGART, EDMONDS, FRANK; EVANS, WALTER EDMUND; AND MARTIN, JOHN HENRY, carrying on business as analytical chemists and metallurgists, under the style of Knight & Chapman & Partners, 14 Old Queen Street, Westminster. (P.D., 9/3/40.) Dissolved as from December 25, 1939, so far as concerns John Henry Martin, who retired.

## Chemical Trade Inquiries

**Egypt.**—The Commercial Secretary to H.M. Embassy in Egypt reports that the Department of Survey and Mines is calling for tenders, to be presented in Egypt by April 1, 1940, for the supply of quantities of sensitive paper for photostat machines and developing and acid fixing powders. Firms desirous of offering goods of United Kingdom manufacture can obtain further details on application to the Department of Overseas Trade, Gt. George Street, London, S.W.1. (Ref. T.Y.16721/40).

## Chemical and Allied Stocks and Shares

THE terms of the important Government loan, which are regarded in the market as very attractive, had the effect of increasing activity in gilt-edged securities. On the other hand, industrial shares came in for a good deal of profit-taking following their recent upward movement, although subsequently the rather lower prices attracted buyers.

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Most shares of companies identified with the chemical and allied trades reflected the general market trend. Imperial Chemical, for instance, were 32s. 6d. compared with 33s. a week ago, while small reactions were shown by British Oxygen, Turner & Newall, British Aluminium, and Murex. The interim dividend of the last-named company is due next month, and the market expects it will be maintained. British Oil & Cake Mills preferred ordinary were 1s. 6d. higher at 41s. 6d., awaiting the impending annual results, while Lever & Unilever at 32s. 4½d. were little changed. Tube Investments were easier at 96s. in accordance with the market trend, although general expectations are that the interim dividend, due in a few weeks, will be maintained. Colvilles at 24s. 6d., Stewarts & Lloyds at 46s. 9d. and Babcock & Wilcox at 48s. were little changed on balance. The annual figures of these three companies can be expected next month.

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B. Laporte were inactive, but held their recent rise to 65s. and Fison Packard maintained the better price of 39s., while British Glues were 6s. 9d. compared with 6s. 6d. a week ago. An improvement from 21s. 3d. to 22s. 6d. was shown in Monsanto Chemicals 5½ per cent. preference shares. Elsewhere, Imperial Smelting ordinary responded with a rise from 13s. to 13s. 7½d., there being hopes that payment of the remaining arrears of dividend on the preference shares may shortly be announced. Wall Paper Manufacturers'

## Company News

Dove Chemical Products, Ltd., 1 Glover Street, Stafford, have changed their name to Evode Chemical Works, Ltd.

Serum Laboratories, Ltd., 19 The Avenue, Radlett, Herts., have changed their name to Phylax Serum Laboratories, Ltd.

Carbohydrol, Ltd., Star Works, Lymm, near Warrington, Cheshire, have increased their nominal capital by the addition of £1,500, in £1 ordinary shares, beyond the registered capital of £1,500.

Worthington-Simpson, Ltd., have declared a dividend of 3 per cent. actual (less tax) due on 6 per cent. cumulative preference shares in respect of half-year ended December 31, 1939, which will be paid March 30.

Gas Producers (Bellay), Ltd., 66 Victoria Street, S.W.1, have increased their nominal capital by the addition of £2,500, beyond the registered capital of £21,500. The additional capital is divided into 50,000 "B" ordinary shares of 1s. each.

Dispensers, Ltd., manufacturers of dispensers and containers for liquid and viscous materials and powders, etc., 50 Farnham Road, Seven Kings, Essex, have increased their nominal capital by the addition of £1,000, in £1 ordinary shares, beyond the registered capital of £1,000.

British Luminescent Powder Laboratories, Ltd., Broad Street House, Old Broad Street, E.C.2, have increased their nominal capital by the addition of £3,400, beyond the registered capital of £100. The additional capital is divided into 3,400 redeemable preference shares of £1 each. Each of the existing 100 shares of £1 each was converted into 10 shares of 2s.

Six companies which are controlled by Beechams Pills, Ltd., have announced interim dividends. Beecham Maclean Holdings, Ltd., are paying a second interim of 5 per cent., making 21 per cent. for the year to date. Veno Drug Co., Ltd., announce an interim of 75 per cent. on the deferred. Yeast-Vite, Ltd., have declared a second interim of 15 per cent. This brings the payment to date to 43 per cent., compared with only one payment in the year to March 31, 1939, of 32½ per cent. A. F. Sherley and Co., Ltd., are paying an interim of 10 per cent. on the deferred. Prichard and Constance (Manufacturing), Ltd., have declared a second interim of 10 per cent. on the deferred.

## New Companies Registered

Anglo Chemical and Ore Co., Ltd. (359,408).—Private company. Capital £1,000 in 1,000 shares of £1 each. To carry on the business of metal merchants, brokers and dealers in metals and metallic substances, ores, coal tar by-products, residues and the products thereof, chemicals, fertilisers and ferro-alloys, etc. Subscribers: Adolf A. Horner, 9 Langland Gardens, N.W.3, and Geo. G. Buckeridge. Adolf A. Horner is the first and permanent governing director. Solicitors: Buckeridge and Braune, 34 Clements Inn, W.C.2.

deferred units rallied to 17s. 6d. and Triplex Glass moved up sharply to 23s., while United Glass Bottle ordinary shares remained firmly held, awaiting the dividend announcement, due in a few weeks. Canning Town Glass shares were better at 5s. 9d.; this company's annual figures also fall to be issued shortly. Elsewhere, Nairn & Greenwich at 55s. 7½d. were lower, but Barry & Staines were well maintained at 32s. 9d. Although there was a small reaction from the best prices touched during the past few days, Pinchin Johnson at 23s. were slightly higher on balance, while International Paint further improved by 1s. 3d. to 81s. 3d. Newton Chambers were around 40s. at Sheffield, awaiting the dividend announcement, due in April.

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Textile and kindred securities were less active, and Courtaulds reacted to 37s. 3d., the disposition being to await the annual meeting on Thursday of next week for any references to outlook for the rayon trade. Lansil ordinary have been rather more active in response to market views that there are reasonable possibilities of satisfactory improvement in the dividend on this class of capital. Borax Consolidated at 27s. 6d. had an easier tendency. General Refractories remained around 8s. 3d. on doubts in the market whether the forthcoming results will show the resumption of dividends. Associated Cement and other cement shares maintained a somewhat steadier tendency, but were less active.

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Boots Drug 5s. ordinary shares were firm at 43s. 6d. on general anticipations that the total distribution for the year is likely to be unchanged, while Beechams Pills deferred, Sangars, and Timothy Whites were steady. Movements in oil shares were mostly against holders, although "Shell" at 81s. 3d. and Trinidad Leaseholds at 77s. 6d. were higher on balance for the week.

